2011 State of the Pavement Report

Based on the 2011 Pavement Condition Survey

California Department of Transportation
Division of Maintenance
Pavement Program

December 2011

Acknowledgments

This report is prepared by the California Department of Transportation, Division of Maintenance, Pavement Program, Office of Planning and Programming and Office of Pavement Management and Performance. It summarizes the 2011 pavement condition survey on the entire Caltrans network.

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The completed 2011 Pavement Condition Report can be downloaded from the Division of Maintenance intranet page:
URL: http://onramp.dot.ca.gov/hq/maint/pavement/planprogram.shtml

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EXECUTIVE SUMMARY

Much like the nation's once-young "baby boomers," the condition of California's state highway has passed through "middle age," and now is heading into its senior years. As a result, the California Department of Transportation (Caltrans) is using high-tech strategies and continually monitoring the State Highway System (SHS) though the Pavement Condition Survey (PCS) to keep the SHS in good shape.

The situation is mixed. More than a quarter of California's highway miles (12,333 lane miles) are in poor condition and 11 percent needs reconstruction. Another 11,053 lane miles need low cost preventive maintenance to keep it in good condition. The remaining 26,132 lane miles had no distress. This examination is first step in a triage system that assures the continuing health of a 60-year-old system.

The aging SHS's 50,000 lane miles need to be maintained even while carrying nearly 35 million vehicles per year. Consequently, Caltrans is turning to advanced technology to keep the system in top condition. The state-of-the-art Pavement Management System (PaveM), will be implemented in 2012, is leading to improved pavement performance data, and similar to any other health maintenance system, it targets future repairs that do the most good for the least amount of money.

Moreover, the International Ride Index (IRI) has been changed to the Federal Highway Administration (FHWA) Standards, which call for less than or equal to 170 inches of surface variation per mile. The FHWA can use the data to compare California's pavement performance to other states, and increases California's chances to obtain more federal funds in the future.

By employing aggressive, quick and preventive treatments, Caltrans can avoid more costly medicine in the future. For example, preventive maintenance costs an average of $80,000 per lane mile, while major rehabilitation work is 10 times more expensive. Annual spending for preventive maintenance been steady since 2008 and the 2007 National Highway System (NHS) routes with smooth ride has increased by about 6 percent. This improvement to poor ride is due to more than a thousand lane miles of maintenance and capital pavement projects: overlaying asphalt, grinding concrete pavement, and milling and replacing asphalt.

In the last four years, Caltrans delivered about $3.65 billion in pavement projects on more than 19,000 lane miles. However, these funds may not be available in the future. Therefore, Caltrans will need to leverage dollars to do more with less. The "2011 Ten-Year Plan" anticipates pavement needs to be $2.9 billion per year over the next decade, although only $406 million per year is available, i.e., only fourteen cents of every dollar. Consequently, distressed lane miles could increase from 26 percent today to 40 percent in the next 10 years.

However, Caltrans is turning to advanced technology to trim its pavement costs and overcome the challenges of maintaining the SHS in the future. Savings, for example, could come through recycling. Caltrans uses recycled tires in some pavement, reducing the pressure on landfills.

According to the “2010 Crumb Rubber Report,” in 2010, nearly 31 percent of all Caltrans flexible pavement, by weight, was designed with rubberized asphalt.

Another Caltrans innovation, mentioned above, is PaveM, advanced computer software that combines radar soundings with automated highway pavement condition survey (APCS). The Ground Penetrating Radar (GPR) shows under the pavement like a CT scan while the APCS collects pavement condition data at highway speeds using lasers and cameras. PaveM can recommend the best strategies for specific roadways as well as the entire SHS. It can predict how long the pavement will last and recommend more cost effective treatments.

CHAPTER 1 – HIGHWAY CONDITION AND NEEDS

The Department is responsible for maintaining the State Highway System (SHS). The SHS has over 15,000 centerline miles and over 50,000 lane miles. In the past, the Department conducted the Pavement Condition Survey (PCS) once a year to measure the changes in the pavement condition. In 2008, the data collection method was changed to provide pavement performance data for the future Pavement Management System (PMS). The 2011 PCS started in July 2009. Due to changes in data collection and reduction in personnel, this survey took about two years to complete. A map of all Districts in California is shown in Appendix 1.

The PCS consists of a visual inspection of the pavement surface using a team of pavement raters and an automated IRI data collection for ride quality. For asphalt pavement, previous surveys had a visual inspection of a 100-foot sample of pavement for every change in pavement condition. For this survey, repeatable samples were taken at the beginning of each post mile regardless of the change in condition. This modification was made to improve pavement performance modeling and obtain consistent comparison. In addition, a number of the asphalt pavement minor surface distress types identified in previous years were eliminated. These included the following:

❖ Raveling	❖ Pumping	❖ Weathering	❖ Settlement crack
❖ Spalling	❖ Poor patch	❖ Shoulder maintenance	❖ Shoulder separation
❖ Potholes	❖ Shoving	❖ Shoulder edge cracking	❖ Shoulder dropoff

For concrete pavement, the concrete slabs are continuously rated in one mile segments. In the 2007 PCS, concrete slab faulting was a minor structural distress and accounted for 2,266 lane miles of the 12,998 distressed lane miles. In the 2011 PCS, slab faulting is no longer identified. The faulting information was imported from the 2007 PCS for those lanes visually rated. Also, the lane next to the outer lane is no longer rated and the methodology for determining cracking was modified. In the 2007 PCS, Stage 1 and Stage 3 cracking on rigid pavement were previously visually identified directly by the pavement evaluator. For the 2011 PCS, slab transverse (width) and longitudinal cracking (length) is recorded and converted to Stage 1 and 3 cracking.

The pavement smoothness is measured using a standardized scale called the IRI. The IRI units are measured by inches per mile. This data measures the relative up and down movement of the vehicle. On a smooth road, such as a newly paved rehabilitation project, the up and down movement is low. On rough pavements, IRI values are high. For the PCS ride quality inspection, the IRI data is automatically collected using lasers mounted on the front bumper of the collection van. This data is collected in each wheel path on the road. The IRI van gathers accurate data from speeds of 10 miles per hour (mph) up to 70 mph and the IRI is computed for every tenth of a mile. For the 2011 PCS, the IRI threshold for poor ride was changed to the Federal Highway Administration (FHWA) Standard of greater than 170 inches per mile. The original thresholds for previous surveys were IRI greater than or equal to 213 for concrete pavement and 224 for asphalt pavement.

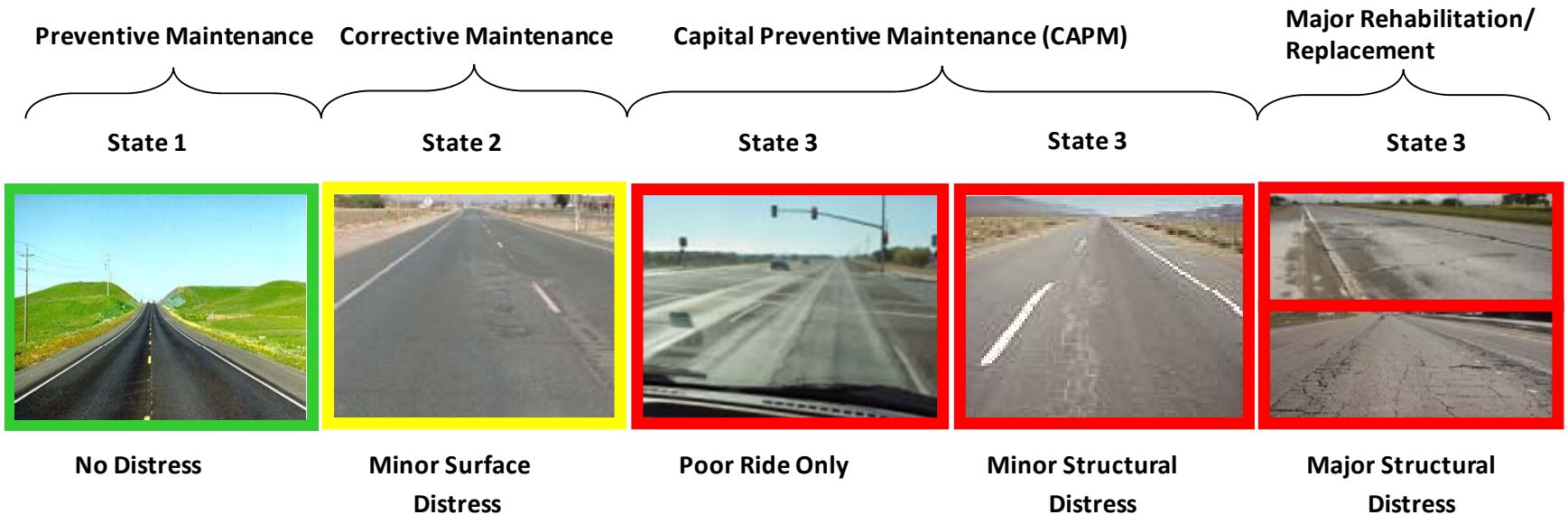
The original PCS was developed in the mid-1970's and a FoxPro database program called Pavement Condition Report (PCR) came into use in 1998. The original system was intended only to identify distressed pavement, i.e. pavement having major distress, minor distress or poor ride. All other surveyed pavement was considered to have little or no distress. In 2004, new functionality was added to the PCR software that further classifies pavement with minor distress or no distress into segments requiring preventive maintenance, corrective maintenance or excellent pavement.

Figure 1 shows the different pavement condition states.

State 1: Pavement in good/excellent condition with no or few potholes or cracks. This pavement requires a preventive maintenance pavement project.

State 2: Pavement is in fair condition with minor surface distress that only needs corrective maintenance. The types of minor surface distress include minor cracking, slab cracking, raveling and potholes. The repair is a corrective maintenance pavement project.

State 3: Pavement includes major distress (pavement in poor condition with extensive cracks), minor distress (pavement in poor condition with significant cracks), and poor ride only. The severity of distressed pavement is defined by both the visual appearance of the pavement and the IRI. The ride quality is based on the FHWA standard that defines an acceptable IRI as 170 or less. The repair is a Pavement Rehabilitation or Reconstruction, lane replacement project or a Capital Preventive Maintenance (CAPM) project.



State 1: Good/excellent condition with few potholes or cracks ⇨ Preventive maintenance project

State 2: Fair condition with minor cracking or slab cracking ⇨ Corrective maintenance project

State 3: Poor condition with significant to extensive cracks or poor ride only ⇨ CAPM , rehabilitation or reconstruction project

Figure 1. Pavement Condition States

Table 1 shows the distribution of lane miles by pavement condition classification and Table 2 further breaks this down by Road Class. (The District breakdown is shown in Appendix 3.) The 2011 PCS began in July 2009 and was completed in June 2011. As shown in Table 1, the PCS identified 12,333 lane miles of distressed pavement requiring CAPM, rehabilitation and reconstruction. The 2011 survey also identified 11,053 lane miles requiring pavement maintenance. Major distress was reduced 2,509 lane miles. This was due to the completion of over 200 rehabilitation and CAPM projects and over 400 maintenance projects since the 2007 survey. Poor ride quality went up due to lowering the IRI threshold to greater than 170 inches per mile.

Table 1. 2011 Pavement Classification by Condition

Pavement Condition	2007			2011		
	Lane Miles[2]	Percent of Distressed Pavement	Percent of System	Lane Miles[2]	Percent of Distressed Pavement	Percent of System
Major Structural Distress	8,102	62	16	5,594	45	11
Minor Structural Distress	3,914	30	8	4,253	34	9
Poor Ride Quality (Only)[1]	981	8	2	2,486	20	5
Total Distressed Pavement	12,998	100	26	12,333	100	25
Pavement Maintenance	16,055	–	32	11,053	–	22
Good/Excellent Pavement	20,424	–	41	26,132	–	53
Total System Lane Miles[2]	49,477	–	100	49,518	–	100

1. 2007 poor ride quality is based on IRI greater than or equal to 224 inches per mile for asphalt pavement and 213 inches per mile for concrete pavement, whereas 2011 poor ride is based on IRI greater than 170 inches per mile.
2. Excludes bridges, ramps and frontage roads.

Table 2. 2011 Pavement Classification by Road Class

Pavement Condition	2007				2011			
	Class 1	Class 2	Class 3	Total	Class 1	Class 2	Class 3	Total
Major Structural Distress	2,872	3,124	2,107	8,102	2,001	2,082	1,510	5,594
Minor Structural Distress	2,396	883	635	3,914	1,918	1,123	1,212	4,253
Poor Ride Quality (Only)[1]	343	366	272	981	938	789	758	2,486
Total Distressed Pavement	5,610	4,373	3,015	12,998	4,858	3,994	3,481	12,333
Pavement Maintenance	7,430	5,211	3,414	16,055	4,331	4,061	2,661	11,053
Excellent Pavement	12,688	4,594	3,143	20,425	16,663	5,905	3,563	26,132
Total System Lane Miles[2]	25,727	14,178	9,572	49,477	25,852	13,961	9,705	49,518

1. 2007 poor ride quality is based on IRI greater than or equal to 224 inches per mile for asphalt pavement and 213 inches per mile for concrete pavement, whereas 2011 poor ride is based on IRI greater than 170 inches per mile.
2. Excludes bridges, ramps and frontage roads.

CHAPTER 2 – VEHICLE MILES TRAVELED ON ROUGH/SMOOTH PAVEMENT

The 2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance – Report to Congress (FHWA, 2008) simplified the measurement of ride quality into two descriptive terms: "Good" or "Acceptable." To be rated acceptable, pavement performance must have an IRI value of less than or equal to 170 inches per mile. According to the FHWA, the IRI value must be less than 95 inches per mile to be rated good.

Figure 2 shows the percentage of Vehicle Miles Traveled (VMT) on rough riding pavement. It is observed that since the 2004 PCS, the percentage of pavement with rough ride has decreased seven percent for National Highway System (NHS) routes. The types of projects that improved the ride included asphalt overlays, grinding and mill/replace asphalt. For non NHS routes, however, the percentage of pavement with rough ride increased on the 2007 PCS but decreased in the 2011 PCS survey. Figure 3 shows the percentage of VMT on smooth riding pavement (IRI < 95 inches per mile). As expected, Figure 3 shows the inverse of the rough pavement chart. The pavement rehabilitation projects repaired the IRI above 170 inches per mile, and at the same time improved lower IRI values as well. Table 3 shows the lane mile distribution of IRI by 3 ranges of IRI, <95, 95-170 and>170 for the 2007 and 2011 pavement condition surveys. Appendix 4 gives a more detailed distribution by Maintenance Service Level and National Highway System.

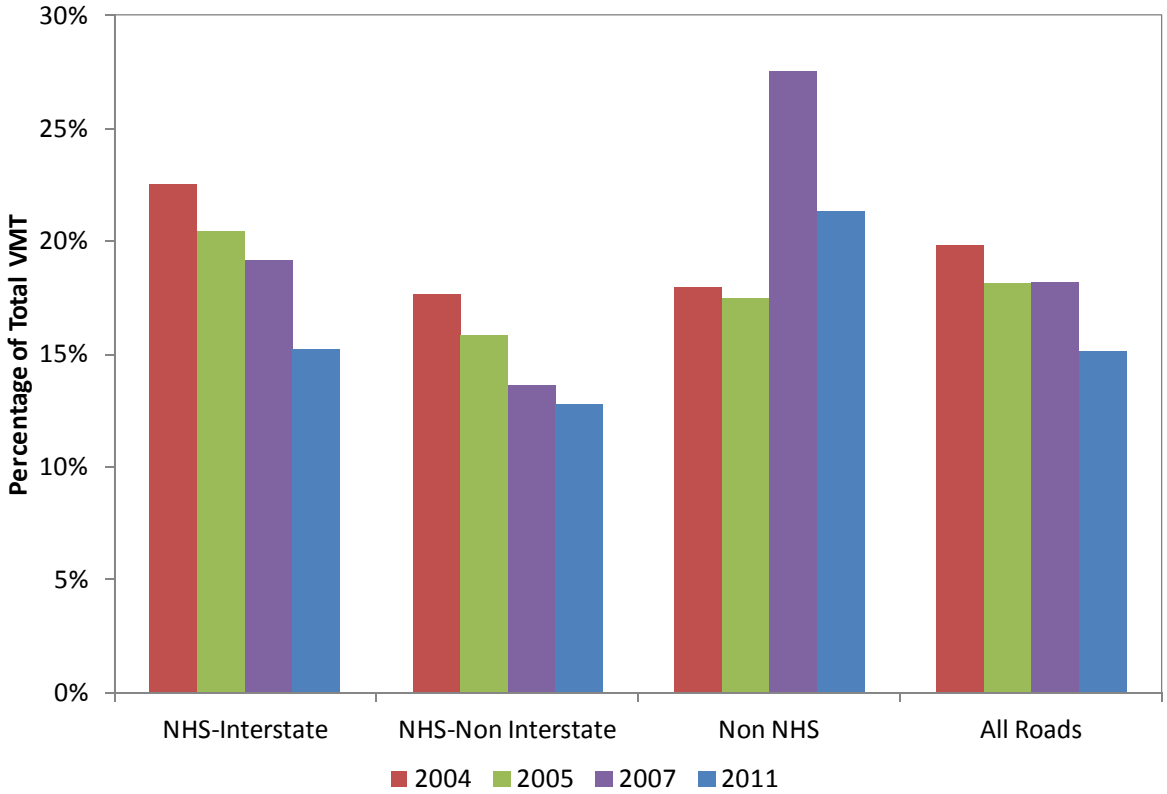


Figure 2. Rough Pavements (IRI > 170 inches per mile)

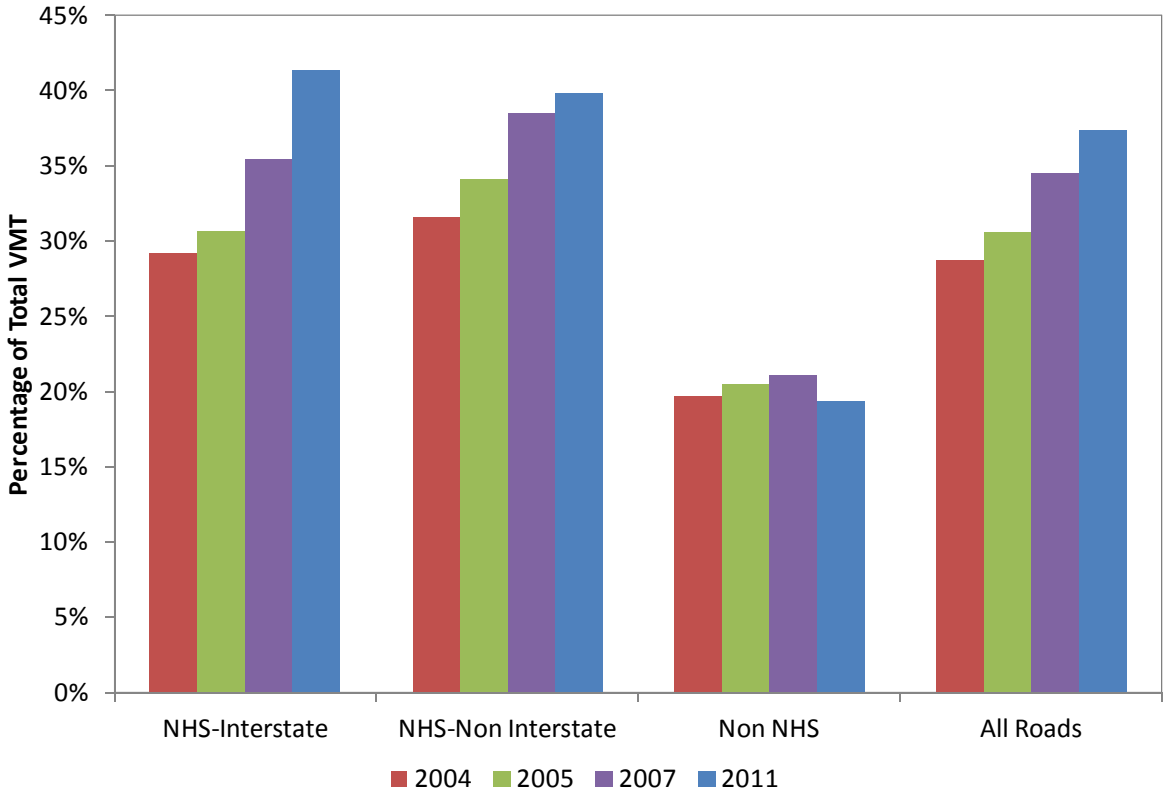


Figure 3. Smooth Pavements (IRI < 95 inches per mile)

Table 3. IRI Distribution by District

District	2007 PCR Lane Miles				2011 PCR Lane Miles			
	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL
District 1	703	1,001	476	2,180	772	995	513	2,280
District 2	2,452	1,281	121	3,855	2,058	1,502	327	3,887
District 3	1,832	2,004	343	4,179	1,684	1,978	494	4,157
District 4	1,277	2,576	1,619	5,472	1,527	2,757	1,336	5,620
District 5	628	519	289	1,436	1,428	1,256	301	2,985
District 6	2,665	2,287	371	5,322	3,132	2,273	267	5,673
District 7	1,300	3,030	1,419	5,749	1,197	2,990	1,716	5,902
District 8	2,342	2,836	995	6,173	2,756	2,875	630	6,261
District 9	1,245	509	25	1,779	1,320	473	57	1,851
District 10	1,278	1,621	473	3,372	1,315	1,761	358	3,433
District 11	1,481	1,849	288	3,619	1,600	1,950	215	3,764
District 12	401	964	454	1,819	506	1,152	265	1,923
Total	17,604	20,477	6,874	44,955	19,295	21,963	6,479	47,737

CHAPTER 3 – PRIORITIZING PAVEMENT NEEDS

As mentioned previously, surveyed pavements are classified into distressed lane miles (major, minor or poor ride only), minor surface distress and no distress. Distressed lane miles are reported in the Department's SHS Performance Measures. The distribution of distressed lane miles is shown in Appendix 2. Ride quality, structural distress, and Maintenance Service Level (MSL) are used to prioritize the distressed pavement lane mile roadway segments for rehabilitation and CAPM work and the minor surface distress lane mile roadway segments for preventive and corrective maintenance work. The combination of ride quality data and structural distress data are used to identify strategies for repairing the pavement. That information is integrated with the MSL value to establish the 'Priority Number' assigned to that pavement. MSL describes the role a route fulfills within the state highway network and the volume of traffic it serves. Table 4 shows the Priority Matrix used to categorize the pavement condition. A matrix of 21 values results from the combination of ride quality, structural distress, and MSL. The value of each pavement segment is used to identify whether a pavement requires a maintenance, rehabilitation or CAPM project. When two pavement segments have identical priority values, determining the site that will receive project development and funding depends on factors such as traffic volume, project costs, and ongoing maintenance expenditures, as well as a detailed condition comparison.

Table 4. Priority Matrix

Ride Quality	Structural Distress	MSL 1	MSL 2	MSL 3
		Priority Number	Priority Number	Priority Number
Poor Ride	Major	1	2	11
	Minor	3	4	12
	None	5	6	12
Acceptable Ride	Major	7	8	13
	Minor	9	10	14
	None	31, 32, 33	31, 32, 33	31, 32, 33
	No Distress	98, 99	98, 99	98, 99

Pavements requiring major or minor rehabilitation have priority numbers less than or equal to 14. They are remedied by projects requiring extensive repair strategies that usually improve the pavement's structural adequacy. For pavements requiring only maintenance work, i.e., priority numbers greater than 14 and less than 98, various strategies are implemented. A Major Maintenance Program priority matrix was implemented to rate this category of pavement. Preventive and corrective maintenance treatments will be performed on pavements based on the distresses shown in Table 5. The pavement is categorized into work groups based on the type of treatment recommended for the distresses observed. The work groups are the basis for the major maintenance budget model and the allocation of funds to the twelve Caltrans Districts for contracting major maintenance. They will also be a basis for the proposed pavement Level of Service (LOS) rating system for all maintenance work (state

forces and contract). This process links budget modeling, allocations and pavement ratings together using actual data collected through the PCS.

Table 5. Maintenance Program Treatment Matrix

Maintenance Type	Work Group	Distress
Preventive	Premium Seal/Overlay	Low Alligator A, Low Alligator B (on High ADT Routes)
	Cracks – Crack Seal	Alligator A, Misc. Cracks
	Chip Seal/Slurry Seal	Alligator A, Low Alligator B (on Low ADT Routes), Miscellaneous Cracks
Corrective	Overlay	Patching, Alligator A, High Alligator B
	Mill & Resurface	Wheel Rutting, High Alligator A, Bleeding
	Slab Replacement	Slab Cracking
	Mill and Resurface (Shoulder)	Joint Depression, Open Cracks, Alligator A & B

CHAPTER 4 – COSTS, EXPENDITURES AND FUNDING

Since the last State of Pavement Report was published in 2007, the cost and expenditure information includes the FYs 2007/08, 2008/09, 2009/10 and 2010/11.

Pavement projects awarded from FY 2007/08 to FY 2010/11 are summarized in Table 6.

Table 6. Pavement Projects Awarded (Capital Cost Only) from FY 2007/08 to FY 2010/11

Type of Pavement Project	FY 2007/08		FY 2008/09		FY 2009/10		FY 2010/11		Total	
	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles
Maintenance	$239	2,900	$240	3,539	$266	3,811	$331	3,305	$1,076	13,555
CAPM	$116	668	$39	175	$69	390	$552	2,342	$776	3,575
Rehabilitation	$345	552	$779	838	$219	207	$452	816	$1,795	2,401
SHOPP Total	$461	1,220	$818	1,013	$288	597	$1,004	3,158	$2,571	5,976
Total	$700	4,120	$1,058	4,552	$554	4,408	$1,335	6,451	$3,647	19,531

In Table 6, the dollars do not include support costs. Details for each fiscal year are described in Appendix 8 for FY 2007/08, Appendix 9 for FY 2008/09 and Appendix 10 for FY 2009/10. Details for FY 2010/11 are discussed in this section.

Figure 4 shows the accomplishments for maintenance, CAPM and rehabilitation projects in terms of contract dollars awarded and lane miles constructed for the 2010/11 FY. In the 2010/11 FY, a total of $1.3 billion of rehabilitation, CAPM and maintenance (preventive and corrective) contracts were awarded on all state highways as follows: $452 million for rehabilitation to repair 816 lane miles of pavement; $552 million for CAPM to repair 2,342 lane miles of pavement and $331 million for maintenance projects to repair 3,305 lane miles of pavement. Eighty-three percent of the total dollar amount was spent on NHS routes.

Figure 5 shows the cost and number of lane miles using a maintenance strategy for contracts awarded in the 2010/11 FY, whereas Figure 6 shows the cost and number of lane miles paved using both rehabilitation and CAPM strategies for contracts awarded in the 2010/11 FY.

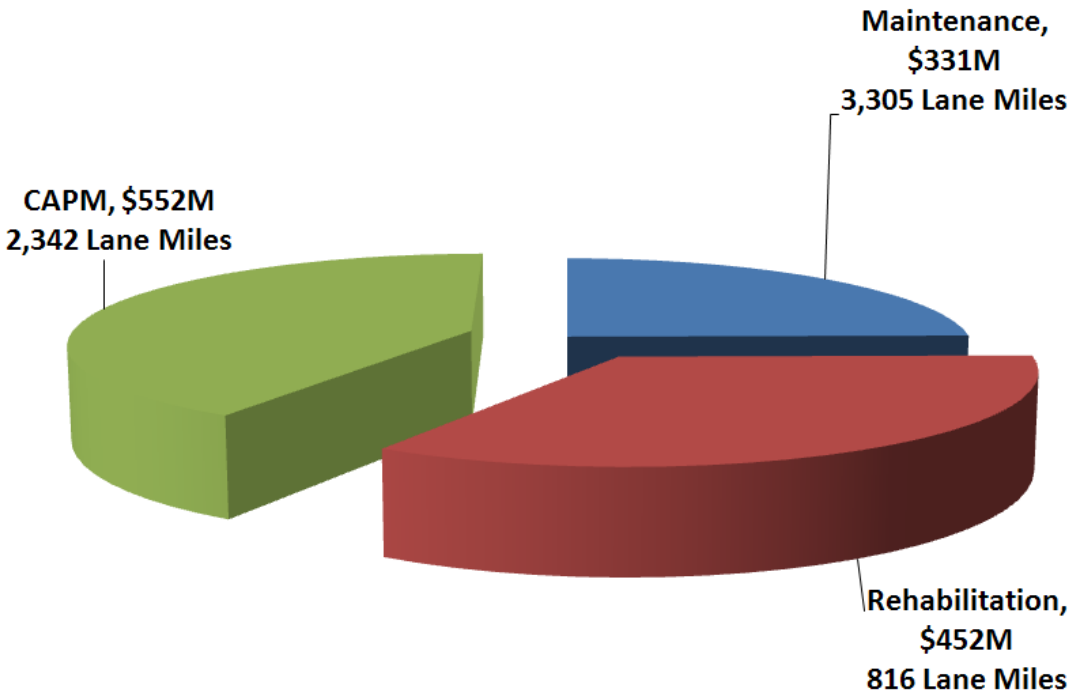


Figure 4. Accomplishments /Contracts Awarded – FY 2010/11

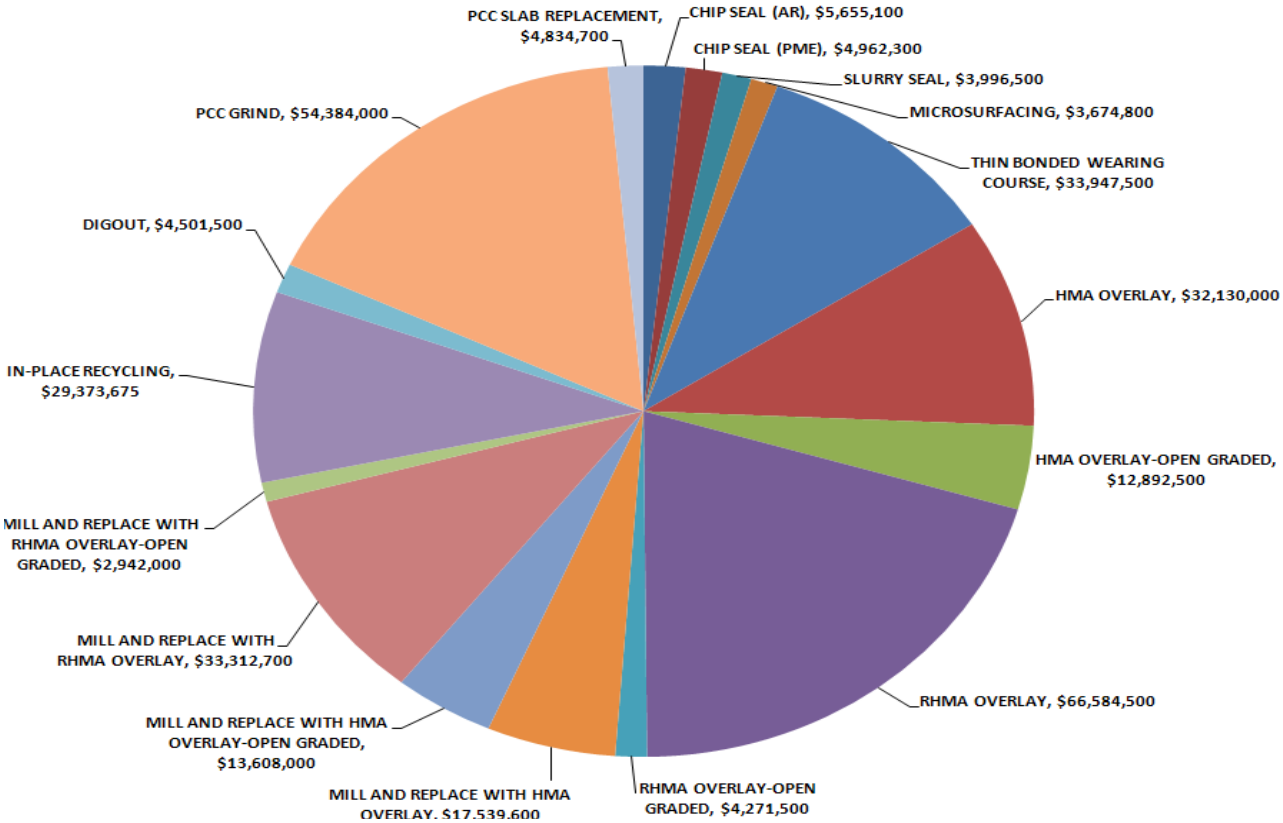


Figure 5. Maintenance (Preventive and Corrective) Projects by Strategy – FY 2010/11

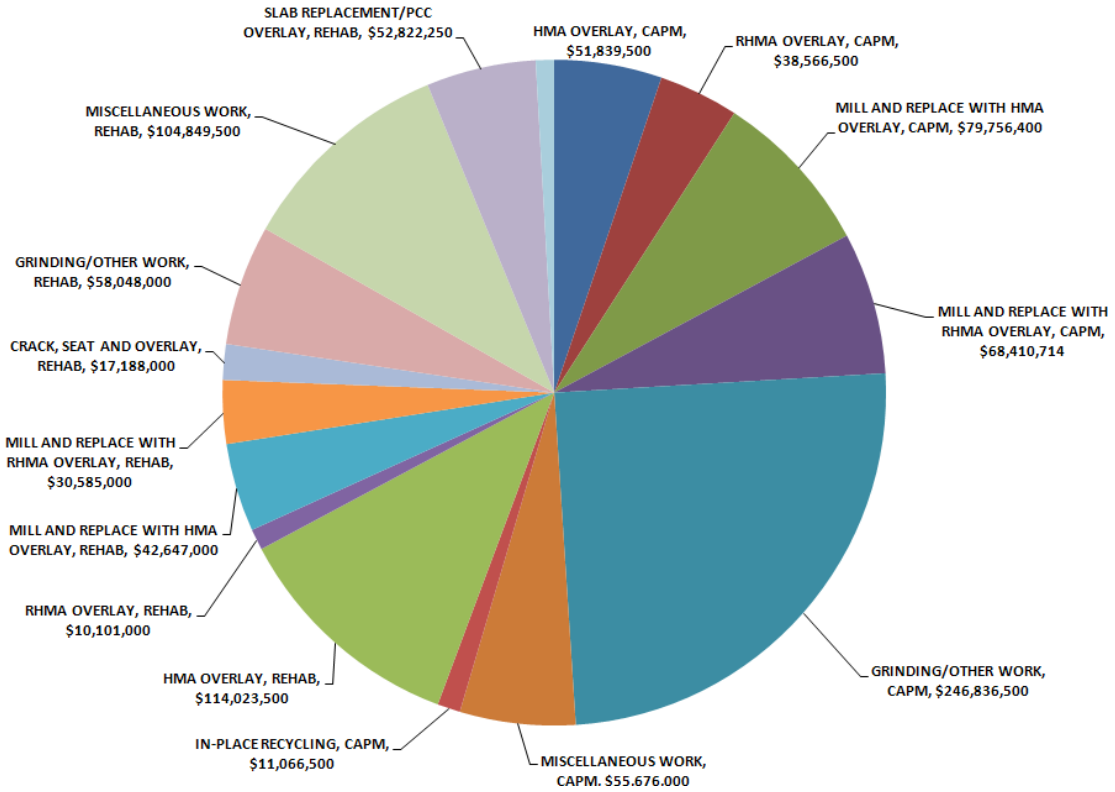


Figure 6. Rehabilitation and CAPM Projects by Strategy – FY 2010/11

CHAPTER 5 - MAINTENANCE AND REHABILITATION PLANS

Five-Year Maintenance Plan

Streets and Highways Code Section 164.6 requires the Department to prepare a five-year Maintenance Plan to address the maintenance needs of the State Highway System. The Pavement Maintenance section of the plan estimated a maintenance backlog of 772 lane miles by FY 2020-21. The long term goal is to reduce the backlog to 500 lane miles. Annually, the current funding for maintenance treatments is $204 million with a treatment goal of 2,700 lane miles. Together, the 2010 SHOPP and the 2011 Maintenance Plan attempt to balance resources between SHOPP and maintenance activities to achieve identified milestones and goals at the lowest possible long-term total cost.

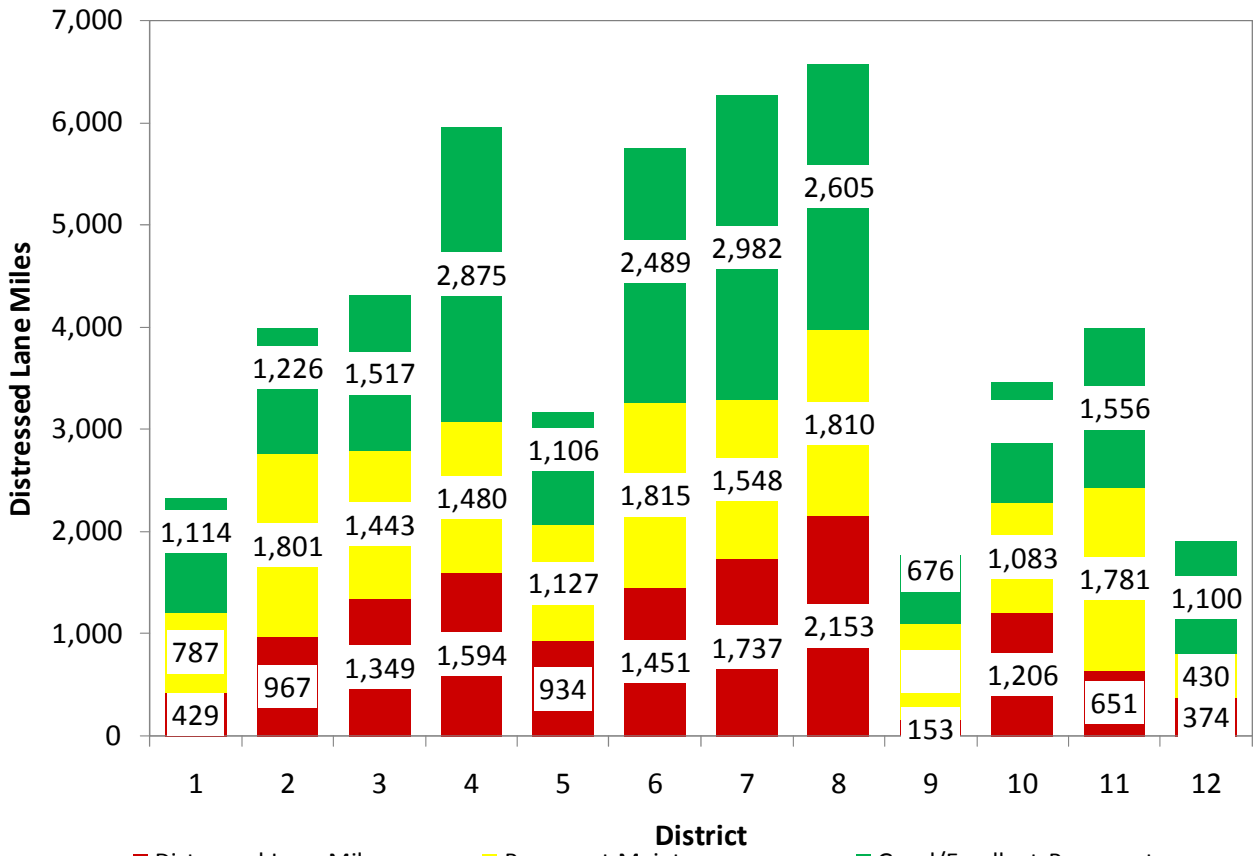
Ten-Year Rehabilitation Plan

Under the Streets and Highways Code Section 164.6, the Department is required to prepare a Ten-Year Plan (TYP) for rehabilitation and reconstruction of all state highways and set performance measures and goals. This plan is to be updated every two years. The 2011 TYP's statewide pavement performance goal is to reduce the total distressed lane miles for the system to 5,500 by FY 2021/22. Each District has a goal to reach in reducing the total distressed lane miles. To reach the statewide goal, all urban Districts need to repair their major structural distressed lane miles. If the funds for pavement rehabilitation decrease, the distressed lane miles will increase. In January 2011, Caltrans published the 2011 TYP. This included the pavement needs of $2.9 billion per year over ten years. However, the projected available funds are $406 million per year. The consequences of this funding shortfall are that the percent of distressed lane miles is predicted to increase from 26 to 40 percent in the next ten years. A sustained level of funding will decrease the distressed lane miles. Table 7 compares the Districts' distressed lane miles from the 2011 PCS to the TYP for pavement preservation performance goals.

Table 7. District Lane Miles vs. Planned Goal for Distressed Lane Miles, 2011

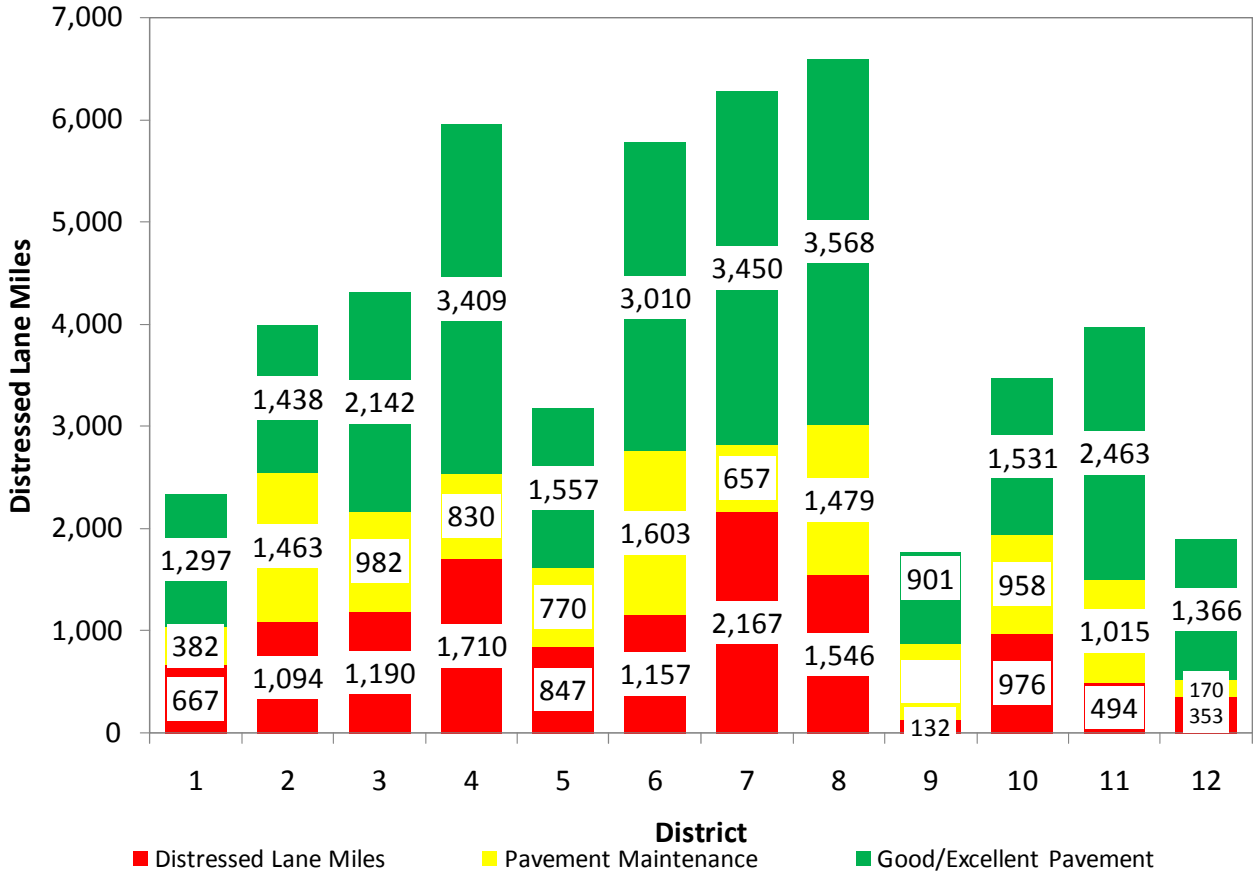
District	Distressed Lane Miles	Performance Goal*	Difference	System Lane Miles	% Distressed Lane Miles
1	667	320	347	2,345	5%
2	1,094	540	554	3,995	9%
3	1,190	560	630	4,314	10%
4	1,710	599	1,111	5,949	14%
5	847	372	475	3,174	7%
6	1,157	611	546	5,770	9%
7	2,167	712	1,455	6,274	18%
8	1,546	660	886	6,593	13%
9	132	146	-14	1,777	1%
10	976	449	527	3,465	8%
11	494	297	197	3,972	4%
12	353	234	119	1,889	3%
TOTAL	12,333	5,500	6,833	49,518	100%

* From the 2011 Ten-Year State Rehabilitation Plan



District	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
System Lane Miles	2,330	3,995	4,309	5,950	3,168	5,755	6,267	6,568	1,777	3,466	3,989	1,903	49,477
Major Structural Distress	251	840	1,026	735	621	1,018	768	1,511	104	888	250	92	8,102
Minor Structural Distress	127	126	311	499	229	412	812	498	46	270	353	232	3,914
Poor Ride Quality	51	1	12	359	84	21	157	145	3	49	49	50	981
Distressed Lane Miles	429	967	1,349	1,594	934	1,451	1,737	2,153	153	1,206	651	374	12,998
Pavement Maintenance	787	1,801	1,443	1,480	1,127	1,815	1,548	1,810	948	1,083	1,781	430	16,055
Good/Excellent Pavement	1,114	1,226	1,517	2,875	1,106	2,489	2,982	2,605	676	1,178	1,556	1,100	20,424
% Distressed Lane Miles	18%	24%	31%	27%	29%	25%	28%	33%	9%	35%	16%	20%	26%

Figure 7. Pavement Condition by District (2007)



District	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
System Lane Miles	2,345	3,995	4,314	5,949	3,174	5,770	6,274	6,593	1,777	3,465	3,972	1,889	49,518
Major Structural Distress	152	699	623	506	433	722	706	860	45	643	129	76	5,594
Minor Structural Distress	312	359	455	492	326	392	721	455	86	281	235	141	4,253
Poor Ride Quality	203	36	113	712	88	44	740	231	1	52	130	136	2,486
Distressed Lane Miles	667	1,094	1,190	1,710	847	1,157	2,167	1,546	132	976	494	353	12,333
Pavement Maintenance	382	1,463	982	830	770	1,603	657	1,479	744	958	1,015	170	11,053
Good/Excellent Pavement	1,297	1,438	2,142	3,409	1,557	3,010	3,450	3,568	901	1,531	2,463	1,366	26,132
% Distressed Lane Miles	28%	27%	28%	29%	27%	20%	35%	23%	7%	28%	12%	19%	25%

Figure 8. Pavement Condition by District (2011)

CHAPTER 6 – COST EFFECTIVENESS OF PAVEMENT STRATEGIES

Figure 9 shows that a preservation treatment should be applied before the pavement deteriorates into a condition warranting a major rehabilitation or reconstruction project.

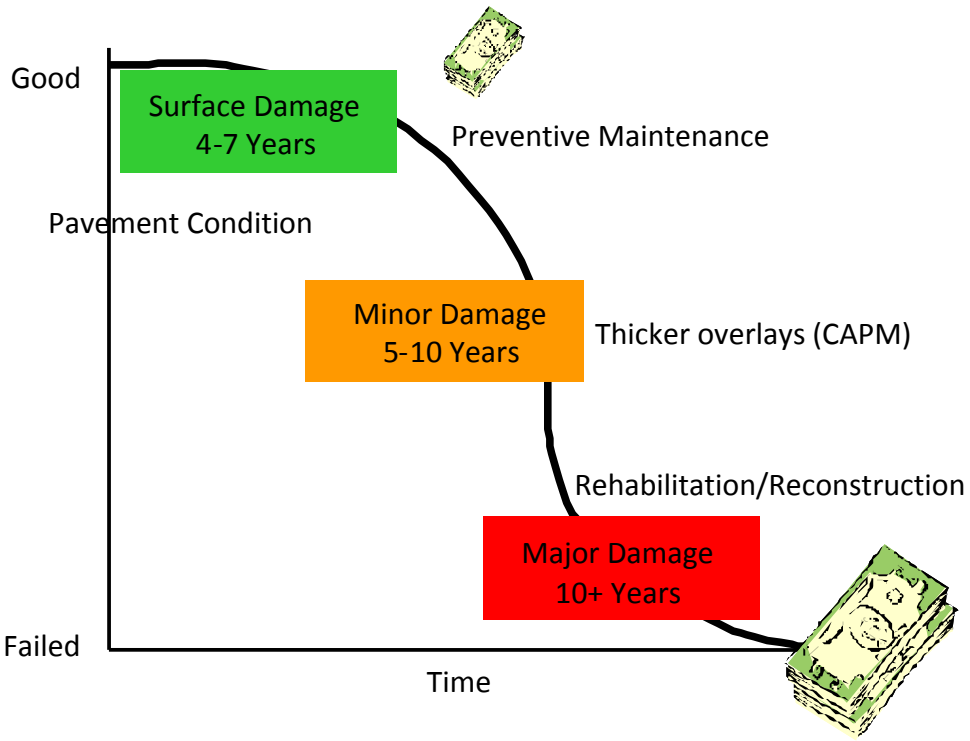


Figure 9. Cost Effectiveness of Pavement Strategies

Preventive maintenance treatments keep good pavement in good shape and studies show that pavement in good condition cost less to maintain. Corrective maintenance treatments are used to remedy most minor surface problems. These maintenance strategies can maintain or extend a pavement's service life four to seven years depending on the traffic volumes and environmental conditions. Maintenance project treatments awarded in FY 2007/08 averaged $82,000 per lane mile, $68,000 per lane mile in FY 2008/09, $70,000 per lane mile in FY 2009/10 and $100,000 per lane mile in FY 2010/11. The average cost for the four years was $80,000 per lane mile.

A CAPM strategy (pavement grinding, isolated slab replacements, or asphalt concrete overlays greater than 1.5 inch, but less than 2.5 inches) is typically performed on pavement with minor distress. A moderate cost CAPM project can successfully restore pavement to an excellent condition and provide a service life of five to ten years. CAPM projects awarded in FY 2007/08 averaged $174,000 per lane mile, $223,000 per lane mile in FY 2008/09, $177,000 per lane mile in FY 2009/10 and $236,000 per lane mile in FY 2010/11. The average cost for the four years was $200,000 per lane mile.

Rehabilitation and reconstruction are the most expensive treatments. They remove and replace the pavement structure rather than the pavement surface. A roadway that is rehabilitated should provide twenty years or more of service life with relatively low maintenance expenditures. The costs for rehabilitation projects, including the upgrade of related facilities, awarded in FY 2007/08 averaged $625,000 per lane mile, $930,000 per lane mile in FY 2008/09, $1,058,000 per lane mile in FY 2009/10 and $547,000 per lane mile in FY 2010/11. The average cost for the four years was $800,000 per lane mile. Summaries of various contracted Maintenance and Rehabilitation treatments for the past five years are provided in Appendices 6 and 7.

The SHS will eventually require substantial rehabilitation or replacement. By delaying rehabilitation, existing conditions deteriorate and the scope of work and costs needed to rehabilitate the facility continue to increase. If timely preservation and rehabilitation are not performed, the life of the facility is reduced and its replacement is needed sooner and is more costly.

CHAPTER 7 – RUBBERIZED ASPHALT CONCRETE

Public Resources Code (PRC) Section 42703 requires that Caltrans use crumb rubber modifier (CRM) in lieu of other materials at increasing levels each year starting in 2007. The Department used about 3.9 million tons of asphalt in calendar year 2010. Table 8 shows that the Department placed about 1.18 million tons of asphalt containing CRM. As a result, the usage of CRM was 30.6 percent of total asphalt.

Table 8. Crumb Rubber Modifier Usage from Calendar Year 2007 to 2010

Type of Pavement Project	Calendar Year 2007			Calendar Year 2008			Calendar Year 2009			Calendar Year 2010		
	Total Tons	RHMA Tons	Percent	Total Tons	RHMA Tons	Percent	Total Tons	RHMA Tons	Percent	Total Tons	RHMA Tons	Percent
Maintenance	659,337	487,275	73.9	906,692	690,958	76.2	1,260,064	764,323	60.7	901,559	557,929	61.9
CAPM	722,857	615,421	85.1	605,759	453,327	74.8	295,357	112,644	38.1	420,125	303,579	72.3
Rehabilitation	1,638,427	355,888	21.7	2,073,430	224,191	10.8	2,202,330	361,084	16.4	691,082	174,950	25.3
Other	1,077,831	30,456	2.8	1,153,454	28,611	2.5	1,832,948	81,137	4.4	1,847,855	145,110	7.9
Total	4,098,453	1,489,040	36.3	4,739,335	1,397,088	29.5	5,590,698	1,319,189	23.6	3,860,621	1,181,569	30.6

The District breakdown is shown in Appendix 11. The total tons of all project types (Maintenance, CAPM, Rehab, and New Construction) are shown as recorded in the Caltrans Major Construction Payment and Information System each calendar year. The program breakdown is the following:

- **Maintenance:** Maintenance funded
- **CAPM:** CAPM/SHOPP funded
- **Rehab:** SHOPP Funded
- **Other:** All other program's projects not listed already above (Safety, Landscape, STIP, Protective Betterment, etc)

CHAPTER 8 – ONGOING SYSTEM IMPROVEMENTS

The Department is adopting innovative tools and best practices that optimize the pavement treatment strategies and improve the pavement design, construction, and maintenance. The life cycle cost analysis will indentify pavement alternatives that have the lowest construction cost, the lowest maintenance cost and impact to the user. Design improvements allow designers to take site-specific information and design pavement treatment strategies to meet performance criteria. Construction improvements include developing end-result and performance-based specifications. These efforts will define the future pavement condition and provide incentives for improved construction methods. Additional improvements include tracking the pavement performance to predict future maintenance needs and optimizing the Department funds. To meet these objectives, the Pavement Program is implementing a new Pavement Management System with three major components: Ground Penetrating Radar (GPR), Automated Pavement Condition Survey (APCS) and software called PaveM.

Ground Penetrating Radar

Ground Penetrating Radar (GPR) is being used to determine the existing pavement structure for the entire network. This methodology was selected based on a research project sponsored by the Department to determine the feasibility of using GPR for the entire network, as described by Kohler et al. (2006). Pavement structure is a major parameter to properly model pavement behavior but this information is not currently available for the entire network. As a result, pavement structure data for the entire network started being collected in February 2010 using GPR, as well as pavement core samples for quality control purposes and geographic information system (GIS) coordinates. The project is nearing completion and all the data for the state highway system has been collected.

Automated Pavement Condition Survey

The automated pavement condition survey (APCS) uses cameras and lasers to collect accurate pavement distress data at highway speeds. The Department is preparing an "Automated Pavement Condition Survey Manual" that reflects the new distresses collected under this new technology and a quality assurance methodology to verify the APCS results. The annual collection of pavement condition data is used to predict pavement performance. This project is also nearing completion with all data collected.

PaveM

GPR, APCS, traffic and climate will be entered into PaveM to predict pavement performance. This prediction will improve as more yearly data is collected. This application will also be capable of optimizing the selection of pavement strategies based on pavement performance prediction, condition of the network and various budget scenarios. PaveM will utilize a web-based system with service-oriented architecture. The project is currently in the testing phase with a roll-out in 2012.

REFERENCES

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FHWA, 2008. "2008 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance – Report to Congress," Federal Highway Administration.

Kohler, E., N. Santero, and J. Harvey, 2006. "Pilot Project for Fixed Segmentation of the Pavement Network," Research Report: UCPRC-RR-2005-11, University of California Pavement Research Center and California Department of Transportation.

APPENDIX

Appendix 1 – Map of Caltrans Districts

Appendix 2 – Distribution of Centerline and Lane Miles in 2011

PRIORITY	Miles	Percent (Total Lane Miles)
Major Structural Distress	5,594	11%
Minor Structural Distress	4,253	9%
Poor Ride Quality	2,486	5%
Pavement Maintenance	11,053	22%
Good/Excellent Pavement	26,132	53%
TOTAL	49,518	100%

Category	Centerline		Lane		Distressed Lane		
MSL	Miles	Percent (Total CL Miles)	Miles	Percent (Total Lane Miles)	Miles	Percent (Total Distressed LM)	Percent (Category Lane Miles)
1	5,926	40%	27,740	56%	5,388	44%	19%
2	5,326	36%	14,177	29%	4,445	36%	31%
3	3,525	24%	7,172	14%	2,499	20%	35%
TOTAL	14,776	99%	49,088	99%	12,333	100%	25%

New routes have not been assigned a MSL classification

	Centerline		Lane		Distressed Lane			Major Structural Distress		Minor Structural Distress		Poor Ride Quality	
DISTRICT	Miles	Percent (Total CL Miles)	Miles	Percent (Total Lane Miles)	Miles	Percent (Total Distressed LM)	Percent (Category Lane Miles)	Miles	Percent (District Lane Miles)	Miles	Percent (District Lane Miles)	Miles	Percent (District Lane Miles)
1	927	6%	2,345	5%	667	5%	28%	152	6%	312	13%	203	9%
2	1,719	12%	3,995	8%	1,094	9%	27%	699	17%	359	9%	36	1%
3	1,451	10%	4,314	9%	1,190	10%	28%	623	14%	455	11%	113	3%
4	1,359	9%	5,949	12%	1,710	14%	29%	506	8%	492	8%	712	12%
5	1,146	8%	3,174	6%	847	7%	27%	433	14%	326	10%	88	3%
6	2,029	14%	5,770	12%	1,157	9%	20%	722	13%	392	7%	44	1%
7	1,068	7%	6,274	13%	2,167	18%	35%	706	11%	721	11%	740	12%
8	1,863	13%	6,593	13%	1,546	13%	23%	860	13%	455	7%	231	4%
9	739	5%	1,777	4%	132	1%	7%	45	3%	86	5%	1	0%
10	1,302	9%	3,465	7%	976	8%	28%	643	19%	281	8%	52	2%
11	977	7%	3,972	8%	494	4%	12%	129	3%	235	6%	130	3%
12	271	2%	1,889	4%	353	3%	19%	76	4%	141	7%	136	7%
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%	5,594	11%	4,253	9%	2,486	5%
ROAD TYPE													
Multi-Lane Divided	5,623	38%	30,458	62%	6,320	51%	21%						
Multi-Lane Undivided	392	3%	1,339	3%	439	4%	33%						
Two-Lane	8,836	59%	17,720	36%	5,573	45%	31%						
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%						
CITY													
City	2,692	18%	15,905	32%	4,319	35%	27%						
Non-city	12,159	82%	33,612	68%	8,014	65%	24%						
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%						
NATIONAL HIGHWAY SYSTEM													
NHS Interstate	2,220	15%	13,435	27%	2,645	21%	20%						
NHS non-Interstate	4,746	32%	17,328	35%	3,563	29%	21%						
Non-NHS roads	7,885	53%	18,755	38%	6,124	50%	33%						
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%						
INTERMODAL CORRIDORS OF ECONOMIC SIGNIFICANCE (ICES)													
ICES	3,341	22%	18,201	37%	3,490	28%	19%						
Non-ICES roads	11,510	78%	31,317	63%	8,843	72%	28%						
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%						
PAVEMENT TYPE													
Flexible	12,152	82%	33,117	67%	8,694	70%	26%						
Rigid	2,701	18%	16,410	33%	3,639	30%	22%						
TOTAL	14,851	100%	49,518	100%	12,333	100%	25%						

Distress	Priority Numbers
Major Structural Distress	1, 2, 7, 8, 11, 13
Minor Structural Distress	3, 4, 9, 10, 12, 14
Poor Ride Quality	5, 6

Excludes bridges, ramps and frontage roads.

Lane miles are rounded to whole numbers.

Appendix 3 – Distribution of Lane Miles by Roadway Class in 2011

District	Major Distress			Minor Distress			Poor Ride Only			Distressed Lane Miles			Maintenance			Good/Excellent			Total Lane Miles			% Total Distressed Lane		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
District 1	41	43	68	49	49	214	21	141	41	110	233	323	126	138	117	838	355	103	1,075	727	543	2%	6%	9%
District 2	121	328	250	34	98	227	4	16	16	159	442	493	235	732	497	511	663	264	905	1,837	1,254	3%	11%	14%
District 3	118	321	183	145	165	145	21	71	20	285	558	348	294	467	221	1,136	762	244	1,715	1,786	813	6%	14%	10%
District 4	225	146	134	204	136	152	166	146	401	595	428	688	411	192	227	2,514	454	440	3,520	1,074	1,355	12%	11%	20%
District 5	155	166	113	85	121	120	6	49	33	246	336	265	273	277	220	647	670	239	1,166	1,283	724	5%	8%	8%
District 6	214	190	318	151	126	115	14	11	19	379	327	452	673	414	516	1,564	618	826	2,616	1,359	1,794	8%	8%	13%
District 7	462	120	125	608	65	48	467	148	124	1,537	333	297	430	153	75	2,481	636	333	4,447	1,122	705	32%	8%	9%
District 8	429	351	80	276	128	50	117	94	19	823	573	149	769	548	163	2,730	594	244	4,321	1,715	557	17%	14%	4%
District 9	8	31	6	4	39	43		1		12	71	49	200	282	261	654	150	98	866	503	408	0%	2%	1%
District 10	138	307	198	61	144	75	5	39	8	204	490	282	243	546	170	765	530	235	1,212	1,566	687	4%	12%	8%
District 11	46	56	27	174	44	17	59	45	27	279	144	71	555	298	163	1,818	254	391	2,652	696	625	6%	4%	2%
District 12	44	24	9	129	7	5	57	29	51	230	59	65	123	19	29	1,005	215	146	1,357	292	240	5%	1%	2%
Total	2,001	2,082	1,510	1,918	1,123	1,212	938	789	758	4,858	3,994	3,481	4,331	4,065	2,661	16,663	5,901	3,563	25,852	13,961	9,705	100%	100%	100%

Appendix 4 – IRI Distribution by Maintenance Service Level and National Highway System, 2007 and 2011

2007 PCR-Lane Miles	MSL 1												MSL 2												MSL 3												TOTAL											
	NHS-Interstate				NHS				Non-NHS				NHS-Interstate				NHS				Non-NHS				NHS				Non-NHS				NHS-Interstate				NHS				Non-NHS				Total			
	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL
District 1	0	0	0	0	656	519	110	1,284	0	1	0	1	0	0	0	0	0	1	1	2	39	322	229	590	0	0	0	0	9	158	137	303	0	0	0	0	656	520	111	1,286	47	481	365	894	703	1,001	476	2,180
District 2	561	114	6	680	808	265	15	1,088	3	0	0	3	0	0	0	0	133	16	1	150	303	227	10	540	90	4	0	94	555	655	89	1,299	561	114	6	680	1,031	285	17	1,332	861	882	99	1,842	2,452	1,281	121	3,855
District 3	723	468	64	1,255	495	321	35	851	131	44	10	186	0	0	0	0	134	111	19	264	275	624	92	990	0	2	0	2	74	435	123	631	723	468	64	1,255	629	433	54	1,117	480	1,103	225	1,807	1,832	2,004	343	4,179
District 4	486	887	277	1,651	606	783	246	1,635	11	47	9	67	0	0	0	0	89	188	40	317	85	623	882	1,590	0	0	0	0	0	48	165	213	486	887	277	1,651	695	971	286	1,952	96	718	1,056	1,870	1,277	2,576	1,619	5,472
District 5	0	0	0	0	321	163	40	524	9	27	13	50	0	0	0	0	2	4	5	10	267	213	185	664	3	7	3	13	27	104	44	175	0	0	0	0	325	175	47	547	302	344	242	889	628	519	289	1,436
District 6	352	102	65	520	1,285	979	124	2,388	0	1	0	1	0	0	0	0	139	101	6	246	657	678	58	1,392	0	22	5	27	231	403	113	748	352	102	65	520	1,424	1,102	135	2,661	888	1,082	171	2,141	2,665	2,287	371	5,322
District 7	527	1,105	654	2,286	527	858	212	1,598	4	78	41	123	1	18	2	21	121	360	160	641	78	443	301	821	42	31	0	73	0	154	51	206	527	1,105	654	2,286	691	1,250	372	2,312	82	675	393	1,151	1,300	3,030	1,419	5,749
District 8	1,342	1,053	375	2,770	364	476	132	972	0	3	6	9	0	0	0	0	125	246	32	403	292	675	256	1,224	16	59	5	80	202	324	190	715	1,342	1,053	375	2,770	506	781	168	1,455	494	1,002	452	1,948	2,342	2,836	995	6,173
District 9	0	0	0	0	751	39	0	790	0	0	0	0	0	0	0	0	81	0	0	81	23	3	3	29	20	10	0	30	370	457	22	849	0	0	0	0	852	49	0	901	393	460	25	878	1,245	509	25	1,779
District 10	269	216	117	602	450	337	42	829	0	1	0	1	0	0	0	0	154	275	58	488	304	415	111	830	4	20	0	24	97	357	145	599	269	216	117	602	608	632	101	1,340	401	773	256	1,430	1,278	1,621	473	3,372
District 11	889	757	108	1,754	92	142	20	254	27	76	11	113	0	0	0	0	160	150	25	335	168	503	122	793	0	0	0	0	145	222	4	370	889	757	108	1,754	252	293	44	589	340	800	136	1,276	1,481	1,849	288	3,619
District 12	118	386	170	674	91	234	131	456	0	19	9	28	0	0	0	0	93	53	0	147	100	272	143	515	0	0	0	0	0	0	0	0	118	386	170	674	184	287	132	602	100	291	152	543	401	964	454	1,819
Total	5,267	5,089	1,836	12,192	6,445	5,116	1,106	12,667	185	298	99	583	1	18	2	21	1,231	1,507	347	3,085	2,591	4,997	2,391	9,978	176	154	13	343	1,709	3,315	1,082	6,107	5,267	5,089	1,836	12,192	7,852	6,778	1,466	16,096	4,485	8,611	3,572	16,668	17,604	20,477	6,874	44,955

2011 PCR-Lane Miles	MSL 1												MSL 2												MSL 3												TOTAL											
	NHS-Interstate				NHS				Non-NHS				NHS-Interstate				NHS				Non-NHS				NHS				Non-NHS				NHS-Interstate				NHS				Non-NHS				Total			
	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL
District 1	0	0	0	0	750	462	61	1,273	0	0	0	0	0	0	0	0	0	1	0	1	20	347	232	599	0	0	0	0	2	185	220	407	0	0	0	0	750	463	61	1,274	22	532	452	1,006	772	995	513	2,280
District 2	551	134	7	691	710	361	21	1,092	0	1	0	2	0	0	0	0	134	17	0	151	214	267	71	553	84	10	0	94	365	711	228	1,304	551	134	7	691	928	388	21	1,337	579	980	300	1,859	2,058	1,502	327	3,887
District 3	682	411	107	1,200	486	326	42	854	128	69	0	198	0	0	0	0	124	120	29	273	208	627	161	996	0	1	0	1	56	423	155	634	682	411	107	1,200	610	447	71	1,129	392	1,120	316	1,828	1,684	1,978	494	4,157
District 4	702	822	203	1,727	639	870	145	1,654	9	46	10	65	0	0	0	0	61	241	47	349	106	714	791	1,610	0	0	0	0	11	64	140	215	702	822	203	1,727	700	1,110	192	2,002	125	825	941	1,891	1,527	2,757	1,336	5,620
District 5	0	0	0	0	928	287	22	1,237	54	60	13	128	0	0	0	0	39	37	6	81	364	545	107	1,016	9	5	1	16	34	322	151	507	0	0	0	0	976	329	29	1,334	452	927	272	1,651	1,428	1,256	301	2,985
District 6	571	168	34	773	1,582	733	48	2,364	0	0	0	0	0	0	0	0	137	208	10	354	613	746	49	1,408	0	21	2	23	229	397	124	751	571	168	34	773	1,719	962	60	2,741	842	1,143	174	2,159	3,132	2,273	267	5,673
District 7	478	1,016	817	2,311	369	887	426	1,682	7	84	51	142	0	0	0	0	236	313	101	649	79	452	277	809	24	47	2	73	4	191	42	237	478	1,016	817	2,311	629	1,247	529	2,405	90	727	370	1,187	1,197	2,990	1,716	5,902
District 8	1,776	1,068	227	3,071	454	461	106	1,022	1	3	1	5	0	0	0	0	67	269	32	368	184	704	151	1,039	3	42	2	46	270	328	112	710	1,776	1,068	227	3,071	524	773	140	1,436	456	1,035	264	1,754	2,756	2,875	630	6,261
District 9	0	0	0	0	839	18	0	857	0	0	0	0	0	0	0	0	78	3	0	81	18	16	1	34	20	15	0	34	366	421	56	844	0	0	0	0	936	36	0	973	384	437	57	878	1,320	473	57	1,851
District 10	475	122	23	620	398	377	75	850	0	1	0	1	0	0	0	0	111	308	66	485	204	555	94	852	3	21	0	24	124	378	100	602	475	122	23	620	512	706	141	1,359	328	934	194	1,455	1,315	1,761	358	3,433
District 11	1,061	778	79	1,918	122	143	14	279	31	72	7	111	0	0	0	0	115	165	18	298	124	572	88	784	0	0	0	0	146	219	9	375	1,061	778	79	1,918	237	308	32	577	302	863	104	1,269	1,600	1,950	215	3,764
District 12	245	431	55	732	89	206	92	387	10	97	25	132	0	0	0	0	77	96	2	175	84	322	91	496	0	0	0	0	0	0	0	0	245	431	55	732	166	302	95	563	94	419	116	629	506	1,152	265	1,923
Total	6,541	4,951	1,550	13,042	7,367	5,131	1,052	13,551	241	434	108	783	0	0	0	0	1,178	1,777	310	3,266	2,217	5,867	2,112	10,196	142	162	8	313	1,609	3,640	1,338	6,586	6,541	4,951	1,550	13,042	8,688	7,071	1,370	17,129	4,067	9,941	3,558	17,566	19,295	21,963	6,479	47,737

Appendix 5 – Distressed Lane Miles by Priority Group

	2003			2004			2005			2007			2011		
District	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality*
1	273	69	12	427	53	6	464	43	4	251	127	51	152	312	203
2	858	114	2	952	86	1	932	51	0	840	126	1	699	359	36
3	1,119	142	27	1,091	129	7	1,333	120	36	1,026	311	12	623	455	113
4	1,041	365	144	1,202	348	57	1,468	323	96	735	499	359	506	492	712
5	772	139	16	880	117	28	747	110	20	621	229	84	433	326	88
6	1,249	204	30	993	203	7	1,199	159	3	1,018	412	21	722	392	44
7	1,003	657	142	1,432	438	94	1,627	526	65	768	812	157	706	721	740
8	1,483	186	50	1,979	186	13	2,021	158	10	1,511	498	145	860	455	231
9	112	40	0	155	55	0	180	60	0	104	46	3	45	86	1
10	833	162	16	900	76	1	1,128	99	0	888	270	49	643	281	52
11	137	233	7	113	301	5	296	253	6	250	353	49	129	235	130
12	58	100	32	133	137	22	124	175	8	92	232	50	76	141	136
Totals	8,938	2,411	478	10,257	2,125	239	11,518	2,078	249	8,102	3,914	981	5,594	4,253	2,486

District Lane Miles by Pavement Condition Survey Year

	2003			2004			2005			2007			2011		
District	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System
1	2,330	354	15%	2,330	485	21%	2,330	511	22%	2,330	429	18%	2,345	667	28%
2	3,992	974	24%	3,995	1,038	26%	3,995	983	25%	3,995	967	24%	3,995	1,094	27%
3	4,284	1,288	30%	4,285	1,227	29%	4,307	1,489	35%	4,309	1,349	31%	4,314	1,190	28%
4	5,958	1,550	26%	5,958	1,605	27%	5,976	1,887	32%	5,950	1,594	27%	5,949	1,710	29%
5	3,187	927	29%	3,187	1,024	32%	3,187	877	28%	3,168	934	29%	3,174	847	27%
6	5,751	1,483	26%	5,751	1,203	21%	5,718	1,361	24%	5,755	1,451	25%	5,770	1,157	20%
7	6,106	1,802	30%	6,158	1,964	32%	6,269	2,219	35%	6,267	1,737	28%	6,274	2,167	35%
8	6,575	1,719	26%	6,575	2,178	33%	6,641	2,189	33%	6,568	2,153	33%	6,593	1,546	23%
9	1,777	152	9%	1,777	210	12%	1,777	240	14%	1,777	153	9%	1,777	132	7%
10	3,462	1,011	29%	3,471	976	28%	3,472	1,226	35%	3,466	1,206	35%	3,465	976	28%
11	3,923	377	10%	3,927	419	11%	3,937	556	14%	3,989	651	16%	3,972	494	12%
12	1,904	190	10%	1,904	292	15%	1,950	307	16%	1,903	374	20%	1,889	353	19%
Totals	49,249	11,827	24%	49,318	12,621	26%	49,561	13,845	28%	49,477	12,998	26%	49,518	12,333	25%

Statewide Pavement Needs by Survey Year and Priority Group

	2003			2004			2005			2007			2011		
Priority	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System
Major	8,938	76%	18%	10,257	81%	21%	11,518	83%	23%	8,102	62%	16%	5,594	45%	11%
Minor	2,411	20%	5%	2,125	17%	4%	2,078	15%	4%	3,914	30%	8%	4,253	34%	9%
Poor Ride	478	4%	1%	239	2%	0%	249	2%	1%	981	8%	2%	2,486	20%	5%
Total	11,827	100%	24%	12,621	100%	26%	13,845	100%	28%	12,998	100%	26%	12,333	100%	25%

Distress	Priority Numbers
Major Structural Distress	1, 2, 7, 8, 11, 13
Poor Ride Qualilty	5, 6

Source: 2003-2007 as published in 2007 State of the Pavement Report. 2011 data from Location Summary Report.
Lane miles are rounded to whole numbers.
Poor ride quality for 2007 is based on an IRI greater than 223 for asphalt pavement and 212 for concrete pavement.
Poor ride quality for 2011 is based on an IRI greater than 170.

Appendix 6 – Maintenance Cost and Usage (2008-2011)

Maintenance, Contracted	Average	07/08	08/09	09/10	10/11
Cost per Lane Mile, by Fiscal Year					
CHIP SEAL (AR)	$ 53,507	$ 50,668	$ 50,467	$ 58,674	$ 54,220
CHIP SEAL (PME)	$ 32,015	$ 28,562	$ 31,827	$ 35,531	$ 32,139
CHIP SEAL (PMA/PBA)	$ 32,823	N/A	$ 35,072	$ 30,574	N/A
CRACK SEAL	$ 8,919	$ 8,919	N/A	N/A	N/A
SLURRY SEAL	$ 35,924	$ 24,840	$ 50,632	$ 37,007	$ 31,217
MICROSURFACING	$ 50,058	$ 61,940	$ 44,433	$ 49,531	$ 44,328
THIN BONDED WEARING COURSE	$ 97,949	$ 100,462	$ 77,866	$ 93,954	$ 119,512
HMA OVERLAY	$ 108,003	$ 121,995	$ 100,747	$ 107,624	$ 101,645
HMA OVERLAY-OPEN GRADED	$ 98,902	$ 87,139	$ 108,563	$ 79,752	$ 120,154
RHMA OVERLAY	$ 88,023	$ 98,528	$ 80,841	$ 76,837	$ 95,888
RHMA OVERLAY-OPEN GRADED	$ 90,712	$ 88,963	$ 76,123	$ 69,874	$ 127,889
MILL AND REPLACE WITH HMA OVERLAY	$ 121,056	$ 136,495	$ 90,143	$ 134,855	$ 122,732
MILL AND REPLACE WITH HMA OVERLAY-OPEN GRADED	$ 111,073	$ 115,741	$ 116,473	$ 79,577	$ 132,502
MILL AND REPLACE WITH RHMA OVERLAY	$ 100,110	$ 107,750	$ 87,972	$ 93,303	$ 111,414
MILL AND REPLACE WITH RHMA OVERLAY-OPEN GRADED	$ 62,407	$ 62,855	$ 43,296	$ 73,429	$ 70,048
IN-PLACE RECYCLING	$ 167,327	$ 170,030	$ 208,080	$ 123,542	$ 167,658
DIGOUT	$ 1,495,460	$ 720,694	$ 1,450,268	$ 1,667,308	$ 2,143,571
PCC GRIND	$ 70,142	$ 95,199	$ 40,585	$ 57,531	$ 87,252
PCC SLAB REPLACEMENT	$ 1,565,813	$ 1,464,368	$ 1,837,677	$ 1,264,823	$ 1,696,386
Lane Miles Treated, by Fiscal Year					
CHIP SEAL (AR)	94	61	130	80	104
CHIP SEAL (PME)	393	375	585	456	154
CHIP SEAL (PMA/PBA)	31	N/A	28	34	N/A
CRACK SEAL	128	128	N/A	N/A	N/A
SLURRY SEAL	162	58	97	363	132
MICROSURFACING	106	122	67	152	83
THIN BONDED WEARING COURSE	348	377	416	314	284
HMA OVERLAY	233	141	253	221	316
HMA OVERLAY-OPEN GRADED	77	117	16	69	107
RHMA OVERLAY	482	358	498	375	694
RHMA OVERLAY-OPEN GRADED	261	271	448	293	33
MILL AND REPLACE WITH HMA OVERLAY	58	10	46	33	143
MILL AND REPLACE WITH HMA OVERLAY-OPEN GRADED	48	14	29	N/A	103
MILL AND REPLACE WITH RHMA OVERLAY	201	186	157	163	299
MILL AND REPLACE WITH RHMA OVERLAY-OPEN GRADED	225	393	394	70	42
IN-PLACE RECYCLING	61	33	14	22	175
DIGOUT	5	9	6	1	2
PCC GRIND	418	175	354	521	623
PCC SLAB REPLACEMENT	5	9	2	6	3
TOTAL, CONTRACT MTCE. LANE MILES	3,212	2,837	3,538	3,172	3,299

N/A - NOT AVAILABLE OR STRATEGY NOT UTILIZED
HMA-Hot Mixed Asphalt
RHMA-Rubberized Hot Mixed Asphalt

1. PCC GRIND IS THE DOMINATE STRATEGY, MAY ALSO INCLUDE ISOLATED SLAB REPLACEMENT
2. MAY INCLUDE HOV LANES, DRAINAGE, OR DIGOUTS
3. MAY INCLUDE LANE WIDENING

* INCLUDES LONG LIFE PAVEMENT REHABILITATION ON LA-710

Appendix 7 – Rehabilitation Cost and Usage (2008-2011)

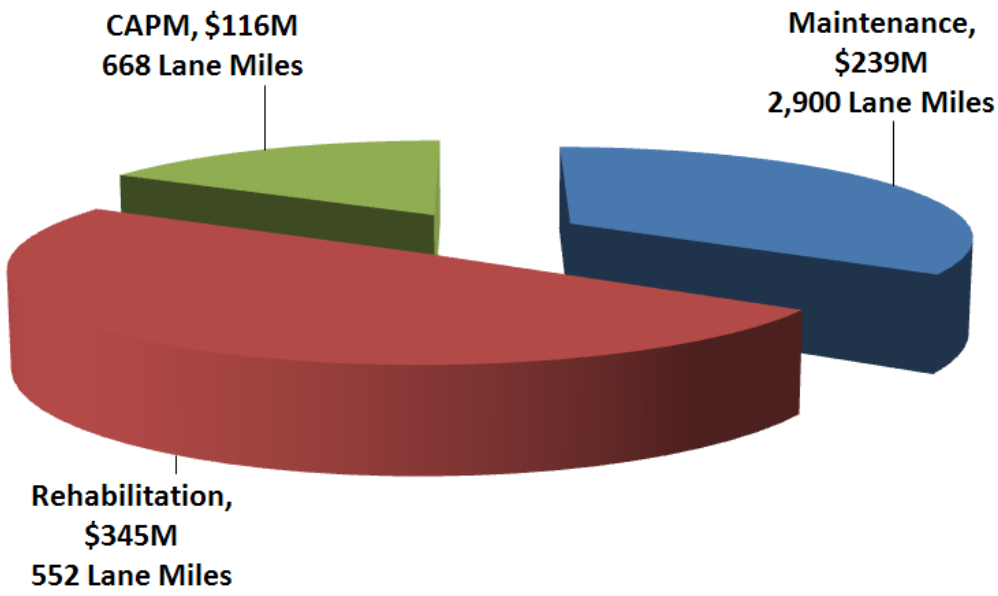
Rehabilitation, Contracted		Average	07/08	08/09	09/10	10/11
Cost per Lane Mile, by Fiscal Year						
	HMA OVERLAY, CAPM	$ 220,626	$ 174,905	$ 216,000	$ 244,037	$ 247,562
	RHMA OVERLAY, CAPM	$ 212,788	$ 202,290	$ 241,747	N/A	$ 194,327
	MILL AND REPLACE WITH HMA OVERLAY, CAF	$ 200,150	$ 184,975	$ 206,192	$ 172,273	$ 237,158
	MILL AND REPLACE WITH RHMA OVERLAY, CA	$ 130,119	$ 132,295	$ 53,551	$ 109,891	$ 224,740
1.	GRINDING/OTHER WORK, CAPM	$ 239,890	$ 138,672	$ 398,264	$ 187,588	$ 235,038
2.	MISCELLANEOUS WORK, CAPM	$ 1,089,461	$ 390,121	$ 961,946	$ 2,757,000	$ 248,776
	PCC OVERLAY/SLAB REPLACEMENT, CAPM	$ 1,865,103	$ 1,178,667	$ 2,551,538	N/A	N/A
	IN-PLACE RECYCLING, CAPM	$ 227,855	N/A	$ 183,807	N/A	$ 271,904
3	HMA OVERLAY, REHAB	$ 532,574	$ 380,933	$ 896,255	$ 326,925	$ 526,181
3	RHMA OVERLAY, REHAB	$ 541,196	N/A	$ 577,342	N/A	$ 505,050
	MILL AND REPLACE WITH HMA OVERLAY, REH	$ 431,686	$ 517,717	$ 585,083	$ 198,538	$ 425,406
	MILL AND REPLACE WITH RHMA OVERLAY, RE	$ 401,358	$ 512,137	$ 561,363	$ 317,750	$ 214,181
	CRACK, SEAT AND OVERLAY, REHAB	$ 731,392	$ 400,000	$ 864,368	$ 1,220,481	$ 440,718
	GRINDING/OTHER WORK, REHAB**	$ 432,563	$ 432,264	$ 279,279	$ 442,836	$ 575,873
2.	MISCELLANEOUS WORK, REHAB	$ 1,495,451	$ 2,777,778	$ 800,000	N/A	$ 908,575
	PCC OVERLAY/SLAB REPLACEMENT, REHAB	$ 2,413,817	$ 4,345,762	$ 1,624,006	$ 2,462,763	$ 1,222,737
	IN-PLACE RECYCLING, REHAB	$ 349,289	N/A	N/A	N/A	$ 349,289
Lane Miles Treated, by Fiscal Year						
	HMA OVERLAY, CAPM	61	19	6	8	209
	RHMA OVERLAY, CAPM	157	278	15	N/A	177
	MILL AND REPLACE WITH HMA OVERLAY, CAF	124	40	110	11	336
	MILL AND REPLACE WITH RHMA OVERLAY, CA	101	55	14	32	304
1.	GRINDING/OTHER WORK, CAPM	410	272	12	307	1,050
2.	MISCELLANEOUS WORK, CAPM	114	4	N/A	<1	224
	PCC OVERLAY/SLAB REPLACEMENT, CAPM	2	2	<1	N/A	N/A
	IN-PLACE RECYCLING, CAPM	29	N/A	18	N/A	41
3	HMA OVERLAY, REHAB	109	16	186	17	217
3	RHMA OVERLAY, REHAB	32	N/A	44	N/A	20
	MILL AND REPLACE WITH HMA OVERLAY, REH	117	283	63	24	100
	MILL AND REPLACE WITH RHMA OVERLAY, RE	57	42	41	1	143
	CRACK, SEAT AND OVERLAY, REHAB	69	95	77	64	39
	GRINDING/OTHER WORK, REHAB**	70	11	137	33	101
2.	MISCELLANEOUS WORK, REHAB	47	4	23	N/A	115
	PCC OVERLAY/SLAB REPLACEMENT, REHAB	90	26	247	43	43
	IN-PLACE RECYCLING, REHAB	25	N/A	N/A	N/A	25
	Subtotal, CAPM	886	669	174	358	2,342
	Subtotal, REHABILITATION	570	476	819	182	803
TOTAL CAPM/REHAB LANE MILES		1,456	1,146	993	540	3,145
TOTAL, ALL CONTRACT LANE MILES		4,668	3,982	4,531	3,712	6,444

N/A - NOT AVAILABLE OR STRATEGY NOT UTILIZED
HMA-Hot Mixed Asphalt
RHMA-Rubberized Hot Mixed Asphalt

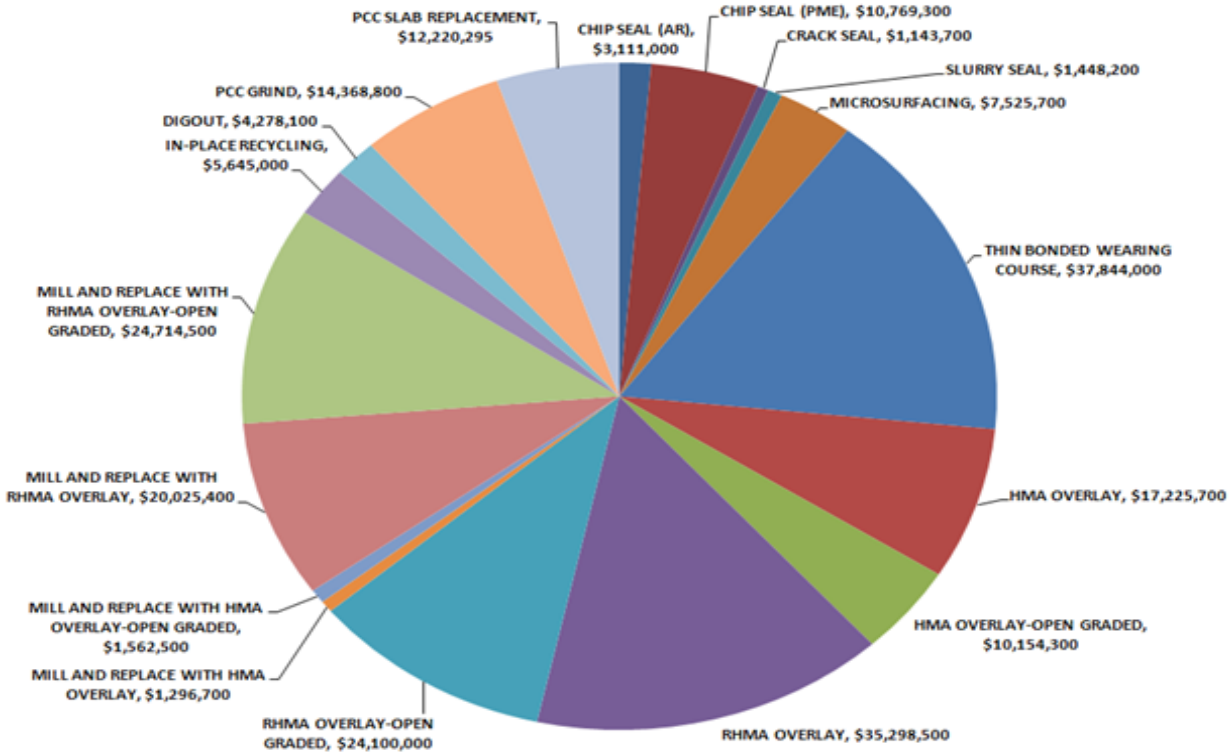
1. PCC GRIND IS THE DOMINATE STRATEGY, MAY ALSO INCLUDE ISOLATED SLAB REPLACEMENT
2. MAY INCLUDE HOV LANES, DRAINAGE, OR DIGOUTS
3. MAY INCLUDE LANE WIDENING
* INCLUDES LONG LIFE PAVEMENT REHABILITATION ON LA-710

Appendix 8 – Accomplishments/Contracts Awarded FY 2007/08

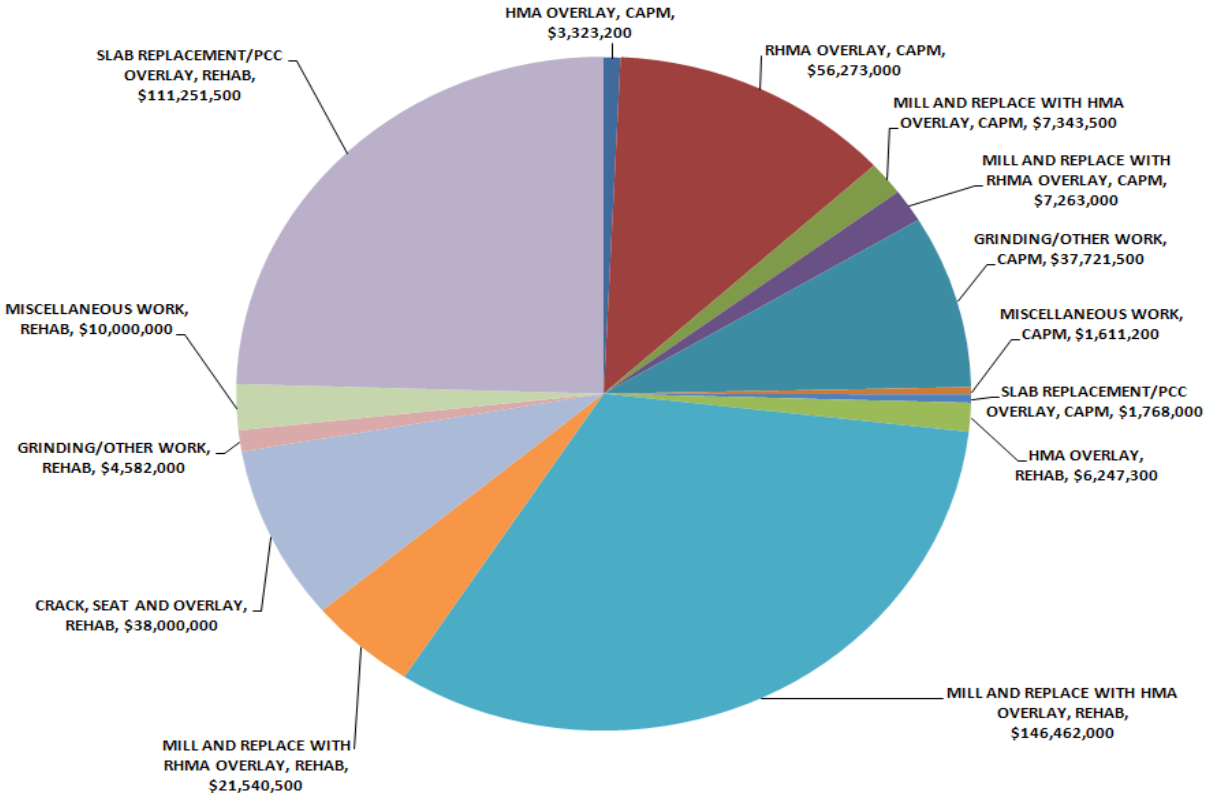
Accomplishments /Contracts Awarded – FY 2007/08



Maintenance (Preventive and Corrective) Projects by Strategy – FY 2007/08

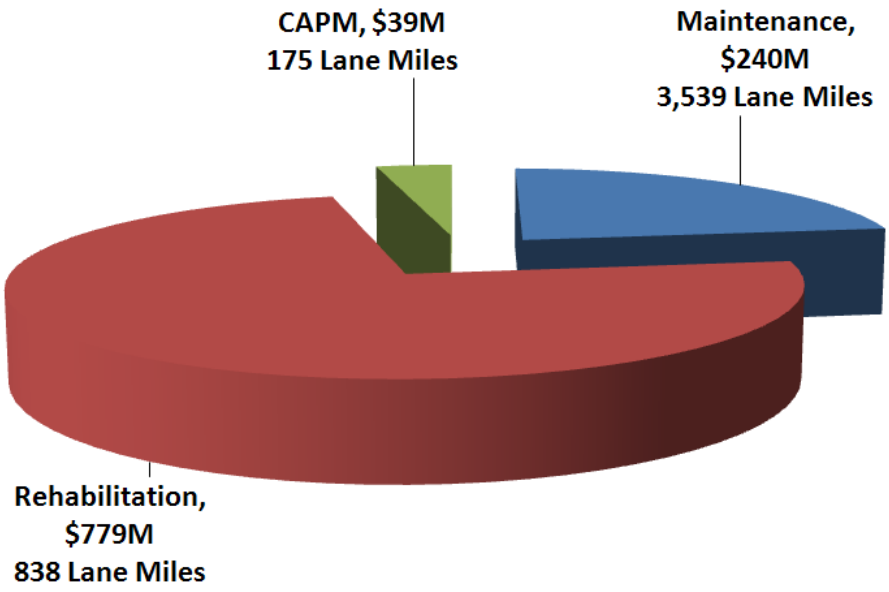


Rehabilitation and CAPM Projects by Strategy – FY 2007/08

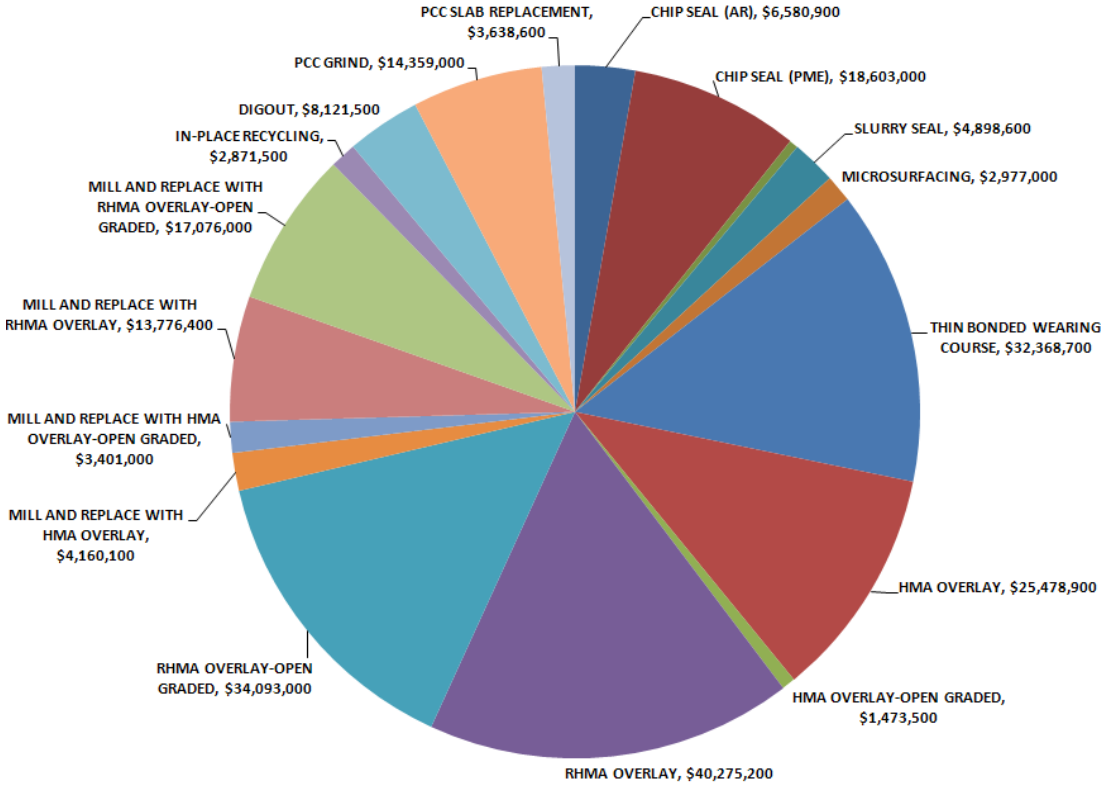


Appendix 9 – Accomplishments/Contracts Awarded FY 2008/09

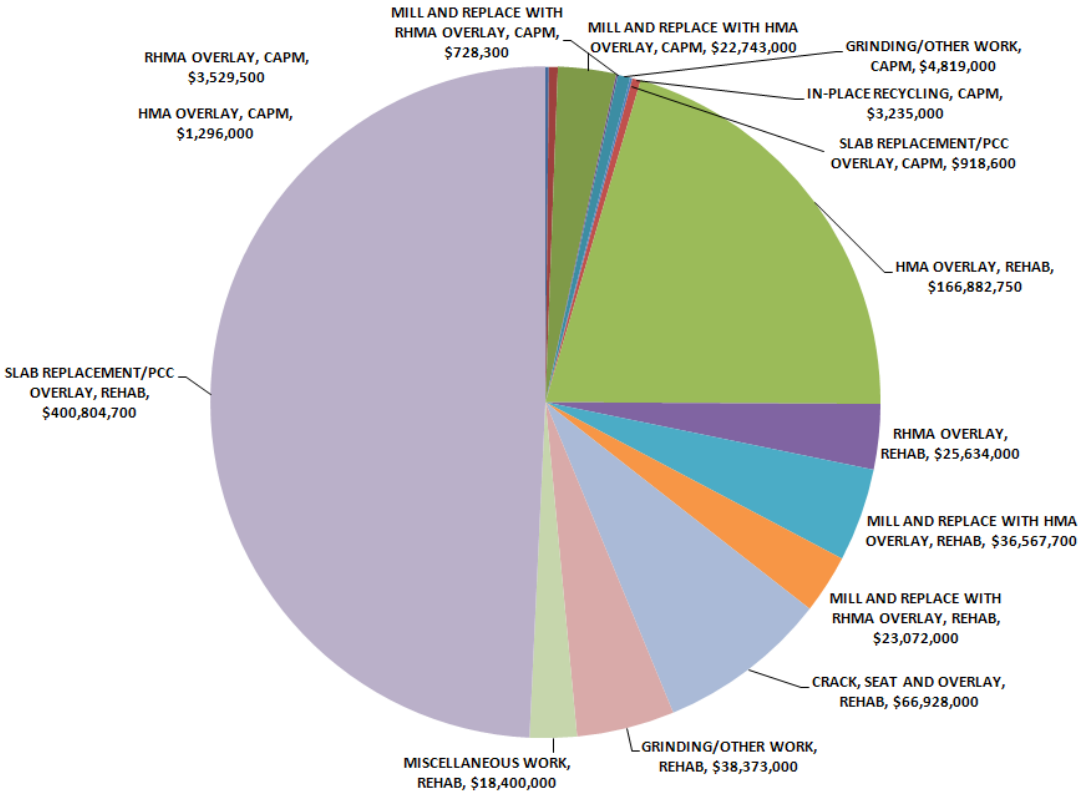
Accomplishments /Contracts Awarded – FY 2008/09



Maintenance (Preventive and Corrective) Projects by Strategy – FY 2008/09

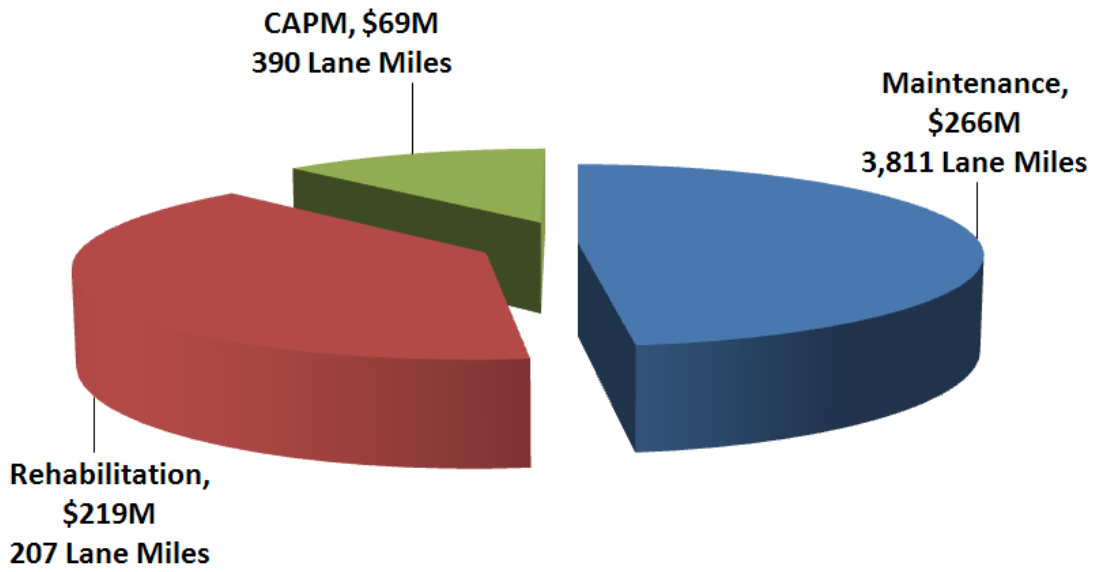


Rehabilitation and CAPM Projects by Strategy – FY 2008/09

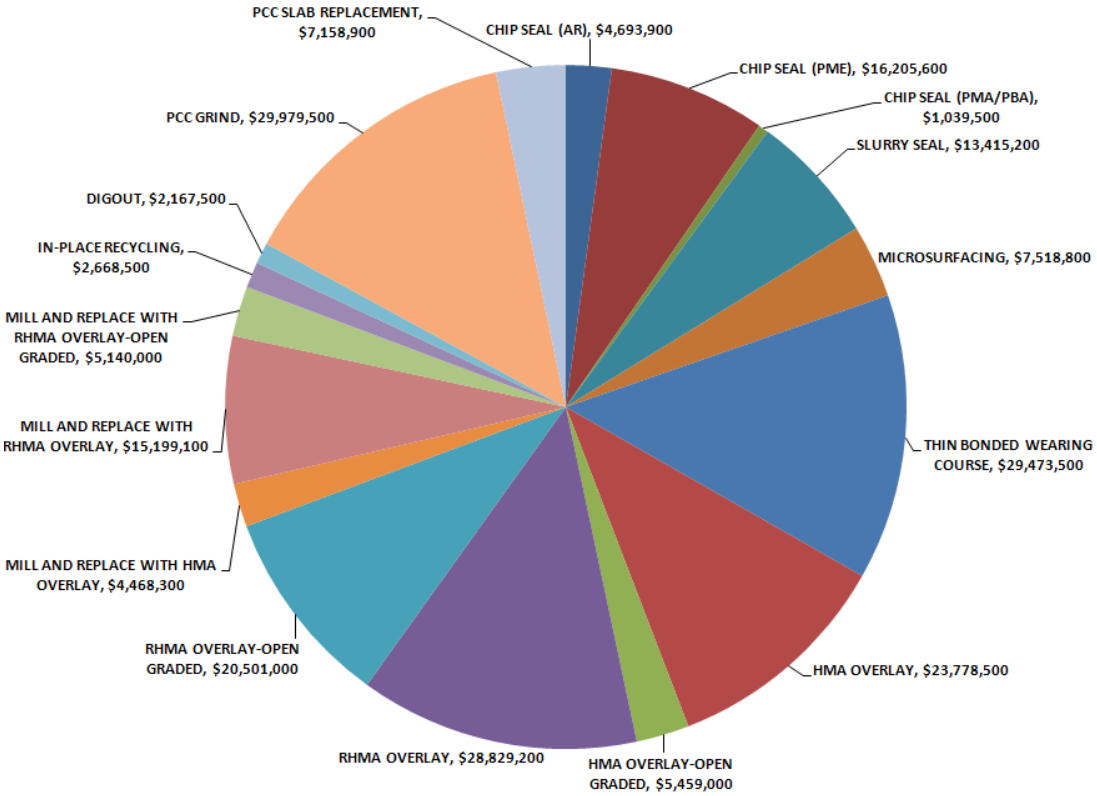


Appendix 10 – Accomplishments/Contracts Awarded FY 2009/10

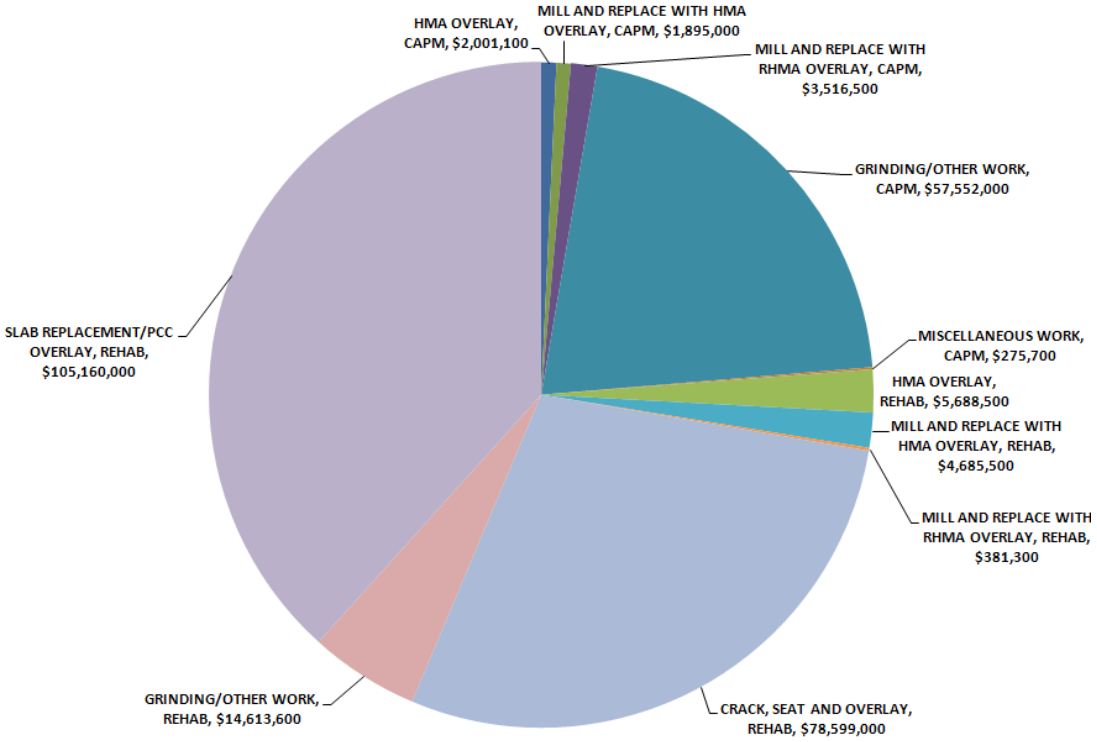
Accomplishments /Contracts Awarded – FY 2009/10



Maintenance (Preventive and Corrective) Projects by Strategy – FY 2009/10



Rehabilitation and CAPM Projects by Strategy – FY 2009/10



Appendix 11 – RHMA Usage by District (2008 to 2010 Calendar Year)

	Calendar Year 2008				Calendar Year 2009				Calendar Year 2010				3-YR Average			
	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%
Maint	64	32	32	50.5%	14	14	0	0.0%	70	40	30	43.3%	49	29	21	42.2%
CAPM	73	11	62	84.8%	0	0	0	0.0%	6	6	0	0.0%	26	6	21	78.3%
Rehab	90	90	0	0.0%	92	7	85	91.9%	0	0	0	0.0%	61	33	28	46.4%
Other	13	13	0	0.0%	115	115	0	0.0%	37	37	0	0.0%	55	55	0	0.0%
D1 Combined	**240**	**146**	**94**	**39.2%**	**222**	**137**	**85**	**38.3%**	**113**	**83**	**30**	**26.7%**	**192**	**122**	**70**	**36.4%**
Maint	111	90	21	19.0%	140	140	0	0.0%	105	105	0	0.0%	119	112	7	5.9%
CAPM	9	9	0	0.0%	0	0	0	0.0%	6	6	0	0.0%	5	5	0	0.0%
Rehab	148	119	29	19.7%	48	48	0	0.0%	6	6	0	0.0%	67	58	10	14.4%
Other	23	23	0	0.0%	63	63	0	0.0%	114	99	15	13.0%	67	62	5	7.4%
D2 Combined	**291**	**241**	**50**	**17.3%**	**252**	**252**	**0**	**0.0%**	**231**	**216**	**15**	**6.4%**	**258**	**236**	**22**	**8.4%**
Maint	9	2	8	82.6%	152	143	9	5.8%	44	28	16	36.2%	69	58	11	15.8%
CAPM	8	8	0	0.0%	166	111	56	33.5%	0	0	0	0.0%	58	40	19	31.9%
Rehab	291	280	11	3.8%	280	280	0	0.0%	106	106	0	0.0%	226	222	4	1.6%
Other	243	243	0	0.0%	352	352	0	0.0%	334	334	0	0.0%	310	310	0	0.0%
D3 Combined	**552**	**533**	**19**	**3.4%**	**950**	**885**	**64**	**6.8%**	**484**	**468**	**16**	**3.4%**	**662**	**629**	**33**	**5.0%**
Maint	37	20	17	46.2%	105	30	74	71.0%	99	36	63	63.7%	80	29	52	64.2%
CAPM	20	5	16	77.3%	7	0	7	93.8%	288	93	195	67.6%	105	33	72	68.8%
Rehab	570	441	129	22.6%	588	461	127	21.6%	141	120	21	14.9%	433	341	92	21.3%
Other	279	280	-1	-0.3%	480	453	28	5.7%	489	398	91	18.6%	416	377	39	9.4%
D4 Combined	**907**	**746**	**161**	**17.7%**	**1,181**	**945**	**236**	**20.0%**	**1,017**	**647**	**370**	**36.4%**	**1,035**	**779**	**256**	**24.7%**
Maint	51	42	9	18.3%	62	27	36	57.5%	74	66	8	10.6%	62	45	18	28.3%
CAPM	76	76	0	0.0%	0	0	0	0.0%	0	0	0	0.0%	25	25	0	0.0%
Rehab	111	111	0	0.0%	146	146	0	0.0%	77	56	21	27.7%	111	104	7	6.4%
Other	95	93	2	2.0%	117	117	0	0.0%	143	143	0	0.0%	119	118	1	0.5%
D5 Combined	**333**	**322**	**11**	**3.4%**	**325**	**290**	**36**	**11.0%**	**294**	**265**	**29**	**9.9%**	**317**	**292**	**25**	**8.0%**
Maint	173	18	155	89.6%	253	72	181	71.5%	67	6	61	91.0%	164	32	132	80.5%
CAPM	90	17	73	81.1%	5	5	0	0.0%	34	8	27	77.6%	43	10	33	76.9%
Rehab	210	181	29	13.8%	187	158	29	15.5%	83	35	47	57.3%	160	125	35	21.9%
Other	38	38	0	0.0%	82	82	0	0.6%	262	262	0	0.0%	127	127	0	0.1%
D6 Combined	**512**	**254**	**258**	**50.3%**	**527**	**317**	**210**	**39.8%**	**445**	**311**	**134**	**30.2%**	**495**	**294**	**201**	**40.6%**
Maint	68	0	68	100.0%	84	19	65	77.4%	55	2	54	97.0%	69	7	62	90.1%
CAPM	0	0	0	0.0%	15	0	15	99.7%	2	0	2	99.5%	6	0	6	99.6%
Rehab	129	115	14	10.9%	352	306	47	13.3%	98	72	27	27.2%	193	164	29	15.1%
Other	133	132	1	0.5%	67	61	5	7.8%	60	58	2	4.0%	87	84	3	3.2%
D7 Combined	**330**	**247**	**82**	**25.0%**	**517**	**386**	**132**	**25.4%**	**216**	**131**	**85**	**39.3%**	**354**	**255**	**100**	**28.1%**
Maint	115	0	114	99.7%	203	29	175	85.9%	150	0	150	100.0%	156	10	146	93.8%
CAPM	54	0	54	99.7%	54	52	2	3.7%	19	4	16	80.5%	42	19	24	56.3%
Rehab	449	449	0	0.0%	338	323	15	4.4%	92	92	1	0.8%	293	288	5	1.8%
Other	93	93	0	0.0%	120	119	1	0.9%	64	64	0	0.0%	92	92	0	0.4%
D8 Combined	**711**	**542**	**168**	**23.7%**	**715**	**522**	**193**	**27.0%**	**325**	**159**	**166**	**51.0%**	**584**	**408**	**176**	**30.1%**
Maint	82	6	75	92.5%	22	9	13	59.6%	26	26	0	0.0%	43	14	29	68.2%
CAPM	0	0	0	0.0%	8	8	0	0.0%	0	0	0	0.0%	3	3	0	0.0%
Rehab	9	9	0	0.0%	127	87	40	31.4%	0	0	0	0.0%	45	32	13	29.3%
Other	77	77	0	0.0%	215	177	38	17.7%	61	35	27	43.2%	118	96	21	18.3%
D9 Combined	**167**	**92**	**75**	**45.0%**	**371**	**280**	**91**	**24.4%**	**88**	**61**	**27**	**30.2%**	**209**	**145**	**64**	**30.8%**
Maint	61	5	56	91.9%	114	9	105	91.9%	103	16	87	84.9%	93	10	83	89.3%
CAPM	245	12	233	95.0%	22	2	19	90.0%	10	0	10	100.0%	92	5	88	94.8%
Rehab	18	14	4	23.3%	31	13	18	58.3%	54	20	33	61.8%	34	16	19	53.8%
Other	82	55	27	33.0%	99	92	7	7.5%	31	24	7	23.3%	71	57	14	19.6%
D10 Combined	**406**	**86**	**320**	**78.8%**	**266**	**116**	**150**	**56.3%**	**198**	**60**	**138**	**69.8%**	**290**	**87**	**203**	**69.9%**
Maint	26	0	26	98.9%	47	2	45	95.9%	17	17	0	0.0%	30	6	24	78.8%
CAPM	30	14	16	52.1%	0	0	0	0.0%	54	0	54	100.0%	28	5	23	82.8%
Rehab	21	21	0	0.0%	10	10	0	0.0%	1	1	0	0.0%	11	11	0	0.0%
Other	35	35	0	0.0%	82	82	0	0.0%	202	202	0	0.0%	106	106	0	0.0%
D11 Combined	**112**	**70**	**42**	**37.1%**	**139**	**95**	**45**	**32.1%**	**273**	**219**	**54**	**19.6%**	**175**	**128**	**47**	**26.7%**
Maint	110	1	109	99.1%	64	1	63	98.1%	93	3	90	96.9%	89	2	87	98.1%
CAPM	0	0	0	0.0%	19	5	14	75.0%	1	0	1	100.0%	7	2	5	75.9%
Rehab	26	18	8	30.0%	2	2	0	0.0%	33	8	25	74.8%	20	9	11	53.6%
Other	44	44	0	0.0%	41	39	1	3.3%	50	47	3	5.9%	45	44	1	3.2%
D12 Combined	**180**	**63**	**117**	**64.9%**	**125**	**46**	**79**	**63.0%**	**176**	**58**	**118**	**66.9%**	**160**	**56**	**104**	**65.1%**
Maint	907	216	691	76.2%	1,260	496	764	60.7%	902	344	558	61.9%	1,023	352	671	65.6%
CAPM	606	152	453	74.8%	295	183	113	38.1%	420	117	304	72.3%	440	151	290	65.8%
Rehab	2,073	1,849	224	10.8%	2,202	1,841	361	16.4%	691	516	175	25.3%	1,656	1,402	253	15.3%
Other	1,153	1,125	29	2.5%	1,833	1,752	81	4.4%	1,848	1,703	145	7.9%	1,611	1,526	85	5.3%
Statewide	**4,739**	**3,342**	**1,397**	**29.5%**	**5,590**	**4,271**	**1,319**	**23.6%**	**3,861**	**2,679**	**1,182**	**30.6%**	**4,730**	**3,431**	**1,299**	**27.5%**

*Tonnage in Thousands

DEFINITIONS/GLOSSARY

AADT (Annual Average Daily Traffic) – Average daily traffic over an entire year, estimated from a traffic sample collected over a one to seven day time period.

Alligator (Fatigue) cracking – Cracks in asphalt that are caused by repeated traffic loadings. The cracks indicate fatigue failure of the asphalt layer. When cracking is characterized by interconnected cracks, the cracking pattern resembles that of an alligator's skin.

Alligator A – A single or two parallel longitudinal cracks in the wheel path; cracks are not spalled or sealed; rutting or pumping is not evident.

Alligator B – An area of interconnected cracks in the wheel path forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; rutting or pumping may exist.

Alligator C – An area of moderately or severely spalled interconnected cracks outside of the wheel path forming a complete pattern; cracks may be sealed.

AR (Asphalt Rubber) – A mixture of asphalt concrete containing rubber 'crumbs' and synthetic binders.

BWC (Bonded Wearing Course) – It is also known as a Thin Bonded Wearing Course (Nova Chip). It is a polymer-modified emulsion typically used as a pavement preservation treatment.

CAPM (Capital Preventive Maintenance) – Use of heavy maintenance treatments such as intermediate thickness asphalt blankets (flexible pavements), or grinding the pavement surface (rigid pavements) to provide five to seven years of additional pavement life.

Centerline Mile – A mile of highway, without considering the number of lanes in the facility.

Chip Seal – A surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and then immediately covered with aggregate and rolled with a pneumatic tire roller.

Corrective Maintenance – A planned treatment, intended to temporarily correct a specific pavement distress or delay future need to rehabilitate the pavement.

CPR (Concrete Pavement Restoration) – May involve surface grinding, slab replacements, or full lane replacement.

Crack, Seat, and Overlay – The existing pavement is cracked into small pieces that are rolled (seated) into the existing roadbed and overlaid with asphalt.

Grinding – Removal of irregularities in the surface of a pavement to improve ride quality, typically on rigid pavement.

Faulting – Slabs of Portland Cement Concrete (PCC) that are tilted, causing a drop off of the departure end of one slab onto the leading edge of the next slab.

Five-Year Maintenance Plan – It is required by Streets and Highways Code Section 164.6. A five-year plan that addresses the maintenance needs of the State Highway System is prepared each odd-numbered year, concurrent with the rehabilitation plan. The plan identifies only maintenance activities that, if not performed, could result in increased SHOPP costs in the future.

Flexible Pavement – Pavement constructed with asphalt concrete, also known as 'bituminous,' 'flexible'or 'black' pavement.

GPR (Ground Penetrating Radar) – It is a technology that produces an underground cross-sectional image of soils and subsurface features.

HA22 (Highway Program Codes 201.120, 201.121 and 201.125) – The highway program(s) that funds long-term corrective strategies such as reconstruction or rehabilitation and capital preventive maintenance of pavements. HA22 program projects are an element of the four-year SHOPP.

HMA (Hot Mixed Asphalt) – Consist of sand, gravel, and a petroleum binder; also called 'bituminous,' 'flexible' or 'black' pavement.

HMA Overlay – Placement of asphalt layers and inner membranes over an existing roadway. Typically, 6 inches of asphalt are added.

HM1 – The highway program which funds Routine and Major Maintenance on the State highway network. HM1 programs are funded from Caltrans' annual operating budget.

ICES (Intermodal Corridors of Economic Significance) – It is California's primary goods movement system. ICES is an interconnected network of freight distribution routes within California that provides direct access among major highways, seaports, airports, rail yards and national and international markets.

IRI (International Roughness Index) – A standardized method of measuring the roughness of the pavement surface developed by the World Bank and expressed in inches per mile or centimeters per kilometer.

Lane Mile – A pavement measuring one mile long and one lane wide. A mile stretch of a two-lane road equals two lane miles. A segment of road one mile long and four lanes wide is four lane miles. This is the unit of measure used to develop the total cost of pavement projects.

Long-life pavement – A pavement intended to last 35 years or more between rehabilitation treatments.

Maintenance – Work either by contract or by State forces that preserves the riding qualities, safety characteristics, functional serviceability and structural integrity of the facilities that comprise the roadways on the State Highway System.

Maintenance Program – The program, within the California Department of Transportation, that is responsible for the preservation and keeping of rights of way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment, and other facilities, in the safe and usable condition to which it has been improved or constructed.

MSL (Maintenance Service Level) – For maintenance programming purposes, the State highway system has been classified as Class 1, 2, and 3 highways based on the MSL descriptive definitions:

- MSL 1 – Contains route segments in urban areas functionally classified as Interstate, Other Freeway/Expressway, or Other Principal Arterial. In rural areas, the MSL 1 designation contains route segments functionally classified as Interstate or Other Principal Arterial.
- MSL 2 – Contains route segments classified as an Other Freeway/Expressway or Other Principal Arterial not in MSL 1, and route segments functionally classified as minor arterials not in MSL 3.
- MSL 3 – Indicates a route or route segment with the lowest maintenance priority. Typically, MSL 3 contains route segments functionally classified as major or minor collectors and local roads with relatively low traffic volumes. Route segments where route continuity is necessary are also assigned MSL 3 designation.

Major Maintenance – Use of various types of surface treatments, such as thin blankets and chips seals, to extend the service life of a pavement, usually by four to seven years. These treatments keep the roadway in a safe, useable condition but do not include structural capacity improvement or reconstruction.

Major Maintenance Budget Model – Budget modeling, using data collected by the PCS, to determine annual needs by applying a cost to maintain the system in a “steady state” condition whereby existing needs are being eliminated at the same rate as new needs develop.

NHS (National Highway System) – Includes five subsystems of roadways important to the nation’s economy, defense, and mobility:

- Interstate – The Eisenhower Interstate System of highways retains its separate identity within the NHS.

- ❖ Other Principal Arterials – Highways in rural and urban areas that provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.

OGAC (Open Graded Asphalt Concrete) – It is also known as Open Graded Blanket. It is a surface layer of asphalt approximately 1 inch thick, containing few fine particles between the larger pieces of aggregate. This allows water to enter the voids and drain out through the edges of the pavement, reducing standing water on the pavement, and improving skid resistance in wet weather.

Pavement Performance Model – A model used to predict pavement performance to develop budget needs and to perform impact analyses in which the effects of different pavement management strategies and funding levels can be demonstrated.

Pavement Preservation – According to the definition of the FHWA Pavement Preservation Expert Task Group, it is ”a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations.”

Pavement Rehabilitation – According to the definition of the AASHTO Highway Subcommittee on Maintenance, it is “structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays.”

PCC (Portland Cement Concrete) Pavement – Pavement constructed with PCC, also known as ‘concrete’ or ‘rigid’ pavement.

PCS (Pavement Condition Survey) – An annual survey of the State Highway System conducted by the California Department of Transportation.

PLOS (Pavement Level of Service) – A needs-based scoring system, using data collected by the PCS to measure the pavement’s condition with respect to maintenance target goals/priorities.

PME (Polymer Modified Emulsion) – A binder used in a seal coat or as a tack coat for construction.

Preventive Maintenance – According to the definition of the AASHTO Standing Committee on Highways in 1997, it is “a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).”

Priority Number – A number assigned to a segment of pavement based on the combination of ride quality, structural condition, and MSL.

Raveling – Wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of binder through weathering and aging.

RHMA – Rubberized Hot Mixed Asphalt – Material produced for hot mix applications by mixing asphalt rubber or rubberized asphalt binder with graded aggregate. RHMA may be dense-, gap- or open-graded.

Rigid pavement – Pavement constructed with Portland Cement Concrete (PCC), also known as 'concrete' or 'PCC' pavement.

Roadway classification (Class 1, 2, 3) – For planning purposes, the State Highway System has been classified as Class 1, 2, and 3 based on the following definitions:

- Class 1 – Contains route segments classified as Interstate and other principal arterials, which are further subdivided as Goods, Truck, and the Strategic Highway Network (STRAHNET).
- Class 2 – Contains route segments classified NHS and the Interregional Road System (IRRS).
- Class 3 – All other routes not included in Class 1 and 2.

Roadway Preservation – The act of keeping the roadway and appurtenant facilities in the safe and usable condition to which it has been improved or constructed.

Roadway Preservation Program – The program, within the Department, that is responsible for preserving the State highway network.

Roadway Rehabilitation Program – The program, within the Department, that is responsible to rehabilitate roadways that ride rougher than established maximums and/or exhibit substantial structural distress. Work incidental to pavement rehabilitation or replacement of other highway appurtenances that are failing, worn out or functionally obsolete, such as drainage facilities, retaining walls, lighting, signal controllers, and fencing.

Routine Maintenance – According to the definition of the AASHTO Highway Subcommittee on Maintenance, it "consists of work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service."

Rutting – A longitudinal surface depression in the wheel path caused by the consolidation or lateral movement of roadbed material under heavy loads.

Seal coat – A sealant applied uniformly to the entire pavement surface, usually with embedded sand or gravel 'chips,' primarily to prevent water infiltration, improve traction, and renew the pavement surface.

State Highway Operation and Protection Plan – It is required by Streets and Highways Code Section 164.6. A ten-year state rehabilitation plan, prepared each odd-numbered year by the Department to identify rehabilitation needs and schedule in order to meet those needs and strategies for cost control and program efficiencies.

SHOPP (State Highway Operation and Protection Program) – It is required by Government Code Section 14526.5. A four-year listing of projects proposed for constructing consistently with the goals and priorities in the latest Plan. SHOPP projects are limited to capital improvements relative to maintenance, safety and rehabilitation of State highways and bridges that do not add new capacity lanes to the system.

Slab – A unit of PCC pavement defined by surrounding joints.

Slurry Seal – A petroleum-based emulsion seal coat (with embedded fine aggregates) applied to the pavement surface.

Spalling – It occurs at joints or cracks when incompressible materials are confined in the opening. It also occurs where uniform slab support is lacking and there is vertical movement due to wheel load impact. It results in progressive widening of the joint or cracks, and ultimately, deterioration of aggregate interlock at the joint.

State Highway Network – The entire system of highways maintained by the Department. For pavement management purposes, excludes bridge decks and ramps.

State Highway System Performance Measures – A periodic report prepared by the Department to track a variety of performance and accountability measures for routine review by Department management and others.

VMT (Vehicle Miles Traveled) – The length of a highway segment multiplied by the Annual Average Daily Traffic divided by the number of lanes.